United States Environmental Protection Agency
Region 10
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Total Maximum Daily Load (TMDL) for Sediments in the Waters of Lake Creek in Coeur d'Alene Lake Subbasin, Idaho

September 2005

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Acronyms

APHA	American Public Health Association
BMP	Best management practice
BURP	Beneficial Use Reconnaissance Project
CDAT	Coeur d'Alene Tribe
CFR	Code of Federal Regulations
CRP	Conservation Reserve Program
EIFAC	European Inland Fisheries Advisory Council
GIS	Geographic information system
IDEQ	Idaho Department of Environmental Quality
ITD	Idaho Transportation Department
IFIM	Instream Flow Incremental Methodology
KSSWCD	Kootenai-Shoshone Soil and Water Conservation District (formerly Kootenai-Shoshone Soil Conservation District [KSSCD])
LA	Load allocation
MOS	Margin of safety
NAS	National Academy of Sciences
NAE	National Academy of Engineering
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric turbidity units
RASI	Riffle armor stability index
RSI	Riffle stability index
SAWQP	State Agricultural Water Quality Program
SCS	Soil Conservation Service
SFI	Stream Fish Index
SHI	Stream Habitat Index
SMI	Stream Macroinvertebrate Index
STORET	USEPA's STOrage and RETrieval database
SWPPP	Stormwater Pollution Prevention Plan
TDS	Total dissolved solids
TMDL	Total maximum daily load
TSS	Total suspended solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WFPB	Washington Forest Practices Board
WLA	Wasteload allocation
WQPA	Water Quality Program for Agriculture

QATSP	Quality Assurance Turbidity Sampling Plan

Total Maximum Daily Load for

Sediments in the Waters of Lake Creek

in Coeur d'Alene Lake Subbasin, Idaho

TMDL AT A GLANCE:

Water Quality Limited?	Yes
Hydrologic Unit Code:	17010303
Criteria of Concern:	Sediments
Designated Uses Affected:	Cold water aquatic life
Environmental Indicators:	Instream total suspended solids (TSS) concentration
Major Source(s):	Cropland erosion and mass wasting
Loading Capacity:	4,894.1 tons/year
Wasteload Allocation:	16.1 tons/year
Load Allocation:	4,878.0 tons/year
Margin of Safety:	0 tons/year (included implicitly)

Executive Summary

Lake Creek is on the 1998 303(d) list of impaired waters due to impacts from sediment, and is located entirely within the Coeur d'Alene Indian Reservation. Lake Creek is listed from Kruse Creek to Coeur d'Alene Lake. The 1998 303(d) list has this segment listed incorrectly as House Creek to Coeur d'Alene Lake that is an error, as House Creek does not exist. Excess sediments in the creek can degrade and decrease the available habitat for aquatic life. Although Beneficial Use Reconnaissance Project (BURP) surveys demonstrate habitat impairment, it is difficult to quantitatively link habitat measures, such as percent fines and pool characteristics, to sediment loading. However, instream measures of sediment concentration can be linked directly to sediment loading. Therefore, the Total Maximum Daily Load (TMDL) is based on numeric instream total suspended solids (TSS) targets and will incorporate future habitat monitoring to assess improvements in aquatic habitat quality. A numeric TSS limit of 25 mg/l has been established when flows are below the 50^{th} percentile (approximately 89cfs) and a 40 mg/L TSS limit when flows are above the 50^{th} percentile (approximately 90cfs). This was based on literature values to represent desired instream sediment conditions and meet designated uses in the tribal and state water quality standards. Statistical analyses were conducted using the TSS limits and observed flows at the Godde monitoring station in Lake Creek to calculate an overall sediment loading capacity for the watershed.

In addition, TSS loadings and necessary reductions were evaluated over a range of flows in Lake Creek to evaluate the times of increased sediment loading and focus future control actions. Observed flows were distributed based on their frequency of occurrence to establish a flow regime for the watershed, and 10 distinct flow ranges were established. The TSS limits and observed flows were then used to calculate loading capacities for each flow range.

To identify the load reductions needed to meet the loading capacities, it was necessary to determine the existing TSS loadings in Lake Creek. Because instream TSS data are limited and turbidity data have been available almost daily since 1996 and for a wider range of flows, turbidity data were used along with flow

as the basis for identifying the existing sediment loadings. For each of the 10 flow ranges, a representative existing turbidity concentration was identified. These turbidity concentrations were then converted to TSS concentrations based on a correlation equation determined by using observed monitoring data. The TSS concentrations for each flow percentile range were used to establish existing TSS loadings for the Lake Creek watershed.

Using observed flow, turbidity, and TSS data, the Lake Creek sediment TMDL was calculated with an overall load allocation to nonpoint sources of 4,878.0 tons/year. This load allocation corresponds to a 56 percent reduction in existing nonpoint source sediment loadings. Idaho Transportation Department (ITD) is the only point source discharging into the watershed of the impaired segment of Lake Creek; the wasteload allocation is 16.1 tons/yr.

An implementation plan for the Lake Creek TMDL will likely be developed by the Coeur d’Alene Tribe and other local agencies after the TMDL is finalized. The main focus of the implementation plan will likely be to reduce sediment inputs from agricultural sheet and rill erosion, restore riparian zones, augment base flow with storage reservoirs, and mitigate flow disturbance and sedimentation due to forest roads. ITD’s stormwater National Pollutant Discharge Elimination System (NPDES) permit for highway construction will incorporate provision that is consistent with this TMDL. ITD will use the Best Management Practices (BMPs) outlined in their Stormwater Pollution Prevention Plan (SWPPP). Follow-up monitoring in Lake Creek is planned to track water quality improvement. The Coeur d'Alene Tribe seeks to continue its ongoing water quality sampling and monitoring in the Lake Creek watershed. The wasteload allocation and TMDL in-stream habitat targets may also be used as quantitative benchmarks that serve as performance indicators of progress towards meeting water quality standards.

1. Overview

Section 303(d)(1)(C) of the Clean Water Act and the U.S. Environmental Protection Agency's (USEPA) implementing regulations (40 CFR Part 130) require the establishment of a Total Maximum Daily Load (TMDL) for the achievement of water quality standards and designated beneficial uses when a waterbody is water quality limited. A TMDL identifies the total amount of a pollutant that can be assimilated by a receiving water while still achieving water quality standards and includes an appropriate margin of safety. The focus of the TMDL is reduction of pollutant inputs to a level (or load) that fully supports the designated uses of a given waterbody. The mechanisms used to address water quality problems after the TMDL is developed can include a combination of best management practices and/or effluent limits and monitoring required through National Pollutant Discharge Elimination System permits.

On the 1998 303(d) list, Lake Creek is identified as ID3549-1998, with the listed segment starting at Kruse Creek and extending 6.32 miles downstream. (note: The 1998 303(d) list has this segment listed incorrectly as House creek, as House creek does not exist. The listed segment is located entirely on the Coeur d'Alene Indian Reservation. Idaho identified Lake Creek as water quality limited because increased sediment loadings to the stream reduced the quality of pools necessary for fish spawning and winter survival.

1.1. General Background[1]

Lake Creek is located in the Coeur d'Alene basin, with portions located in the Coeur d'Alene Indian Reservation, Kootenai County, Idaho, and Spokane County, Washington (Figure 1-1). Lake Creek drains into Windy Bay on the western side of Lake Coeur d'Alene (Figure 1-2). The watershed of the impaired segment of Lake Creek is approximately 21,560 acres (33.7 mi^2), with 27 percent (5,748 acres [9 mi^2]) located in Spokane County, Washington, and the remainder (15,812 acres [24.7 mi^2]) on the Coeur d'Alene Reservation and in Kootenai County, Idaho. Approximately 57 percent of the impaired watershed is located on the Coeur d'Alene Indian Reservation (7,415 acres [19.2 mi^2]).

The Coeur d'Alene Tribe (CDAT) reports current land uses as agriculture (36 percent), forest (60 percent), urban (< 1 percent), and land enrolled in the Natural Resources Conservation Service (NRCS) Conservation Reserve Program (CRP) (4 percent), which is primarily grassland (CDAT, 2000). The CRP is a national program that provides funds to farmers not to farm their land and to allow the native plants and trees to grow, reducing the loss of highly erodible soils. Land uses have remained steady, with agricultural conversion balanced by reforestation of former agricultural lands. Figure 1-3 presents the distribution of watershed land use, based on U.S. Geological Survey (USGS) Land Use and Land Cover data, indicating similar land use percentages as CDAT (2000).

Elevations in the watershed range from approximately 5,100 feet at the headwaters on Mica Peak, Washington, to approximately 2,200 feet at the downstream point of the impaired segment. The watershed experiences flashy hydrology, with high runoff events and low summer flows, and is strongly influenced by rain-on-snow events in late winter and early spring (CDAT, 2000). In 1997, daily average discharge varied from a peak of 1,150 cfs on January 1 to a low of 1.44 cfs on August 30 (data from KSSCD, 1997). This is similar to the discharge variability reported by Eylar (1990) for Lake Creek. Data on hydrologic changes caused by land use in the Lake Creek Watershed is presently too sparse for quantitative assessment. However, the general relationship of percent forest cover to peak discharge is revealed by use of the standard USGS peak discharge equation. The equation was run using locally based coefficients, average annual precipitation of 30 in/yr, the land area upstream of Godde station, and three scenarios of forest cover. The 80% scenario represents pre-settlement forest cover, 10% cover as a

[1]KSSCD (1998) and CDAT (2000) are recommended as sources of background information on the basin.

watershed-wide present day average, and 1% as an extreme deforestation scenario. Results are given in Table 1-1.

Table 1-1. Estimated peak discharge scenarios for Lake Creek.

	Alternative 1	Alternative 2	Alternative 3
Area (sq mi)	27	27	27
Precipitation (in/yr)	30	30	30
Canopy cover (%)	80	10	1

		Estimated Peak Discharges (cfs)		
Interval (yr)	Alternative 1	Alternative 2	Alternative 3	Std. Error
5	343	532	862	66.6%
10	467	753	1278	62.2%
25	777	1307	2323	63.3%
50	872	1529	2847	71.0%
100	1097	2004	3908	88.0%

The 50 and 100 year peak discharges predicted under the present-day (Alternative 2) scenario generally agree with the peak discharge of 1900 cfs reported by (KSSCD 1998) for a major flood event in February, 1996. Given the land use changes and the number of "100 year" events since the turn of the century, one hesitates to assign a numerical recurrence interval to peak discharge events. Assuming that climatic conditions are consistent in the long-term, the more interesting result is the transfer of a large percentage of the annual water input to short-lived peak runoff events. Based on conservation of mass, the transfer must come from ground storage and/or evapotranspiration (ET) components of the pre-settlement water budget. This concurs with observations of Coeur d'Alene Tribal elders, who tell of the numerous springs (= ground storage), which existed in the Lake Creek area, but have since disappeared. Stream geometry varies with the flow, with widths between 10 and 40 feet and depths between 0.5 and 3 feet.

The Lake Creek watershed has a subhumid climate, with warm, dry summers and cool, wet winters. The average daily maximum temperature in July is 85 degrees, while the average daily minimum temperature in January is 21 degrees. The upper elevations receive 35 inches of precipitation, with two-thirds of the annual precipitation falling between October and March, primarily as snow (KSSCD, 1991).

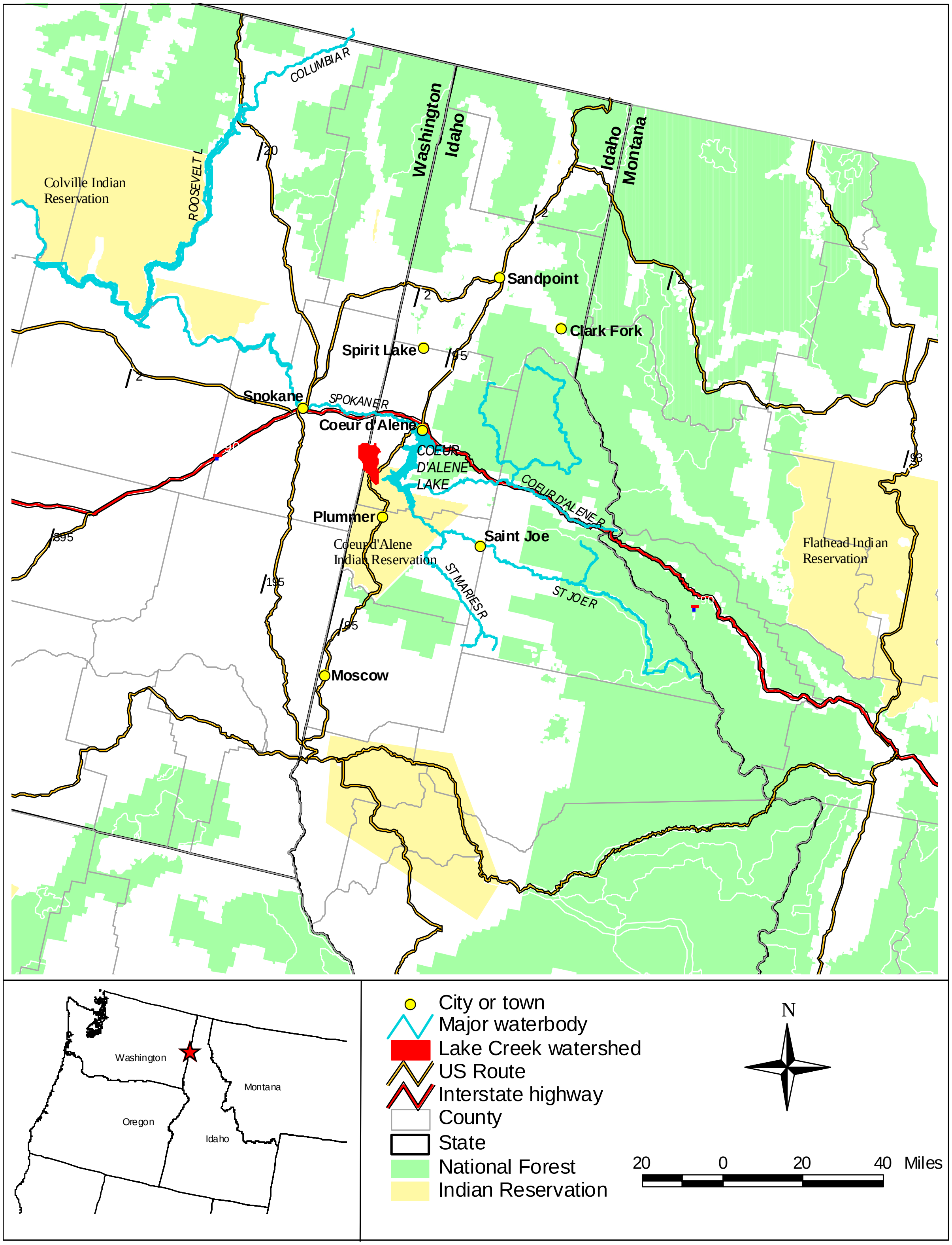


Figure 1-1. Regional setting of the Lake Creek watershed.

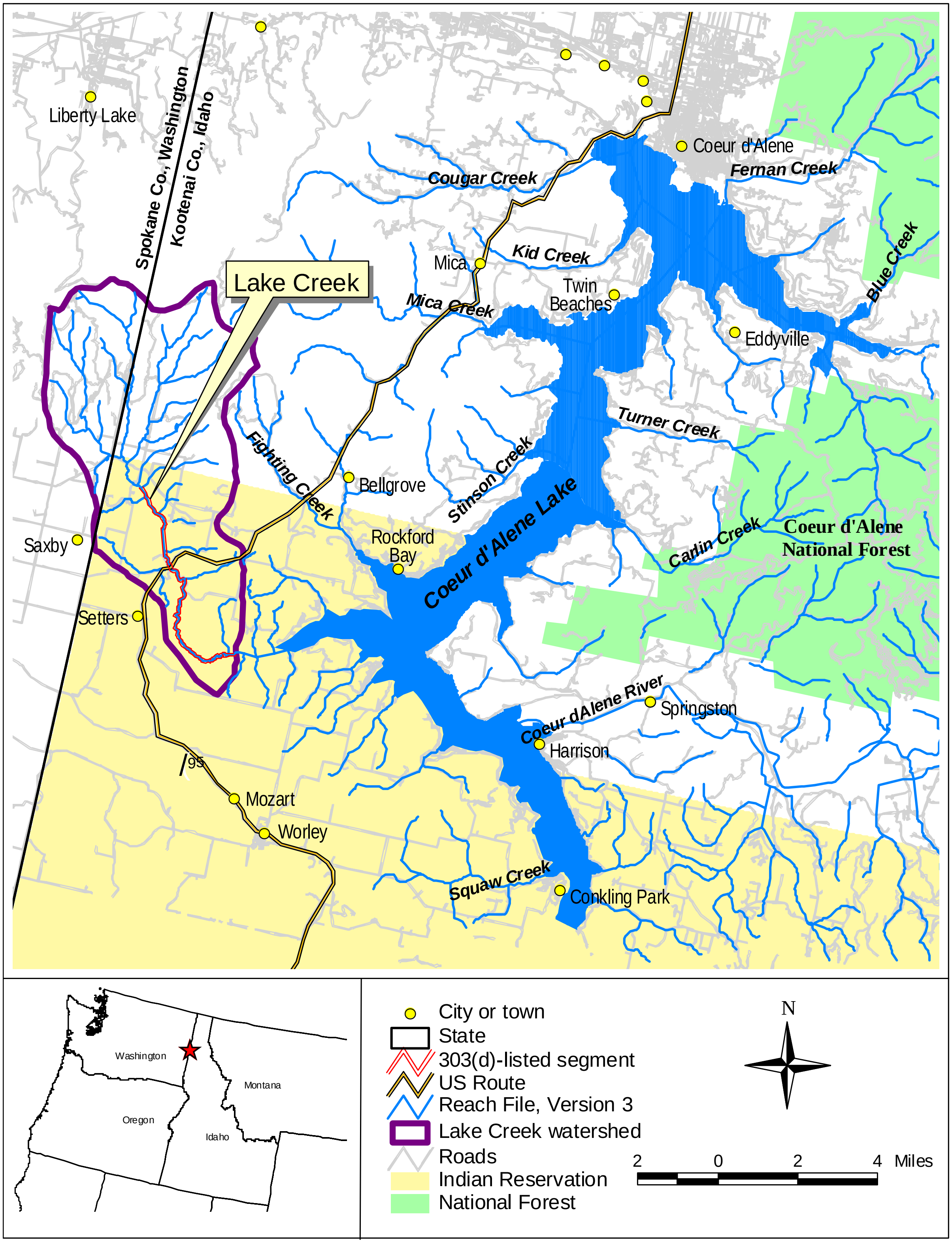


Figure 1-2. Location of the Lake Creek watershed.

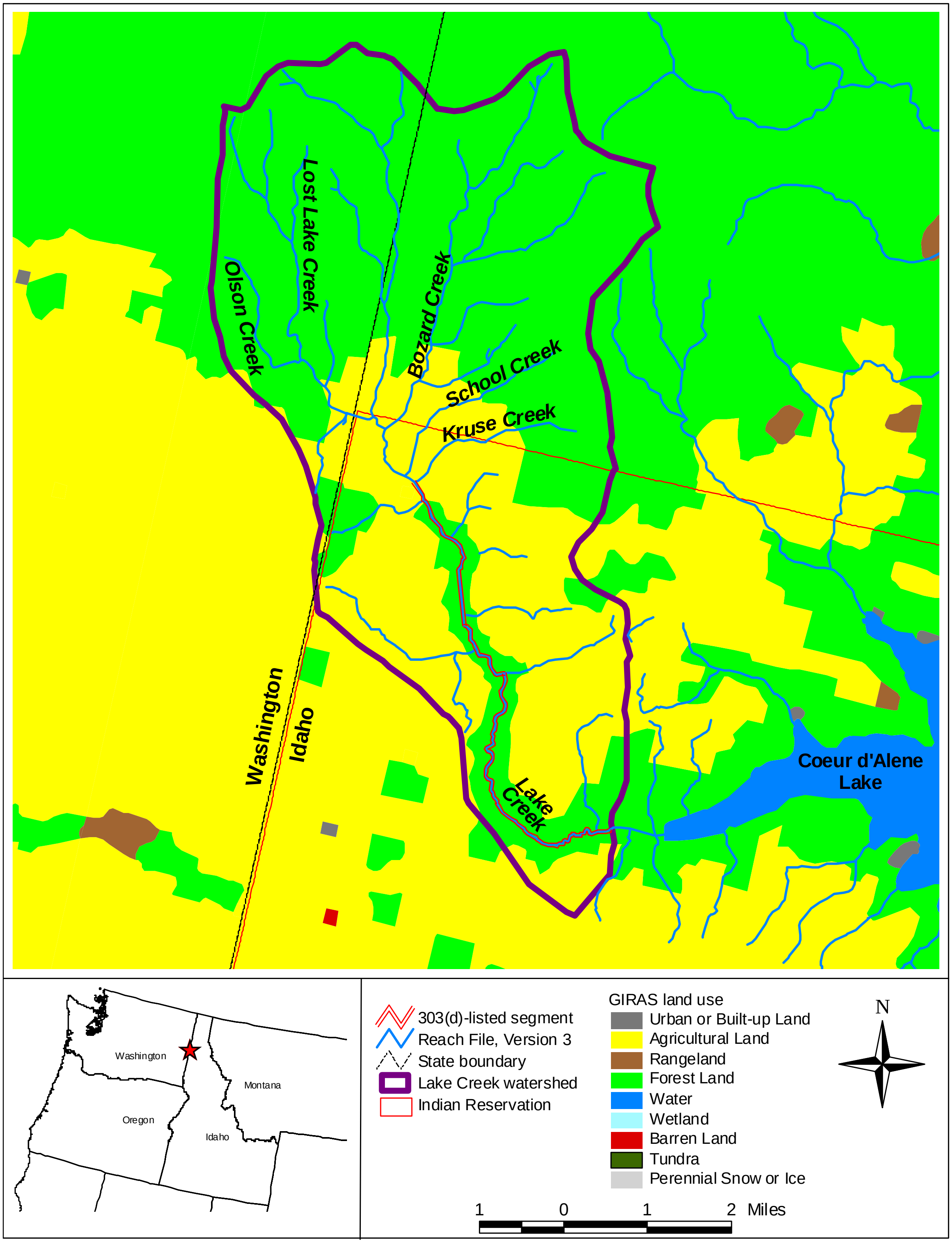


Figure 1-3. Land use in the Lake Creek watershed.

1.2. Designated Use Impacts

Sediment can affect aquatic life uses in several ways, including the following:

- Sediment deposition can fill pools, reducing aquatic habitat, particularly for refuge and rearing.
- Sediment deposition can fill interstitial spaces between gravel, reducing spawning habitat by trapping the emerging fish and reducing the exchange of oxygen necessary for fish embryos.
- Suspended sediment and turbidity can prevent fish from seeing food in the water and can clog their gills.
- High levels of suspended sediment can also result in fish avoiding the stream.

Data available for Lake Creek from the CDAT and Idaho Department of Environmental Quality (DEQ) indicate that Lake Creek is impaired because of sediment that has reduced its use for aquatic life, particularly fish spawning.

The CDAT's Water Resource Program completed the draft *Lake Creek Watershed Assessment* in July 2000. The watershed assessment indicated that Lake Creek only partially supports its use for salmonid spawning and cold water biota and that its use by salmonids is limited by suspended sediment, turbidity, and excessive summer temperatures. The assessment indicated that sediment inputs to Lake Creek will likely be deposited in the channel and that the present response of the creek is fine sediment aggradation, with the system experiencing degradation of salmonid spawning conditions. Percent of fine sediment in the channel substrate and riffle:pool ratios exceeded the optimal limits for salmonid spawning and rearing. Fish population surveys indicated limited usage of Lake Creek by cutthroat trout, likely due to fine sediment, lack of plunge pool habitat, and high summer water temperatures. Although there is data indicating Lake Creek may have high summer temperatures it was the consensus of the TMDL team that measures taken to reduce sediment input into the stream would also decrease instream temperature. Temperature in Lake Creek will be monitored annually and re-assessed during the implementation phase of this TMDL.

In 1999, Idaho DEQ completed a Sub-basin Assessment for the Coeur d'Alene Lake and River (IDEQ, 1999). The Sub-basin Assessment reviews existing data for waterbodies in the sub-basin that were included on the 303(d) list as water quality limited. Data reviewed for Lake Creek include instream water quality data collected for a study of baseline water quality for the Lake Creek Agricultural Project, pool measurements, and fish population data. Based on the data reviewed, the Sub-basin Assessment indicates that Lake Creek experiences turbidity levels that exceed the sight feeding criterion for cold water aquatic life, has diminished residual pool volumes, and has measured fish populations an order of magnitude below reference streams. The Sub-basin Assessment concluded that Lake Creek is impaired by sediment and requires a sediment TMDL. The Lake Creek Watershed was also assessed using Idaho DEQ's Beneficial Use Reconnaissance Project (BURP) data. Idaho DEQ uses BURP data to calculate stream habitat indices for evaluation of aquatic life use support (Grafe, 2002). The BURP data indicates that Lake Creek does not fully support its aquatic life use. Results are included in Appendix A.

2. TMDL Target

Water quality standards designate the “uses” to be protected (e.g., aquatic life, recreation, secondary contact recreation, cold water aquatic community, drinking water, recreation, fish and wildlife habitat) and the “criteria” for their protection (e.g., how much of a pollutant can be present in a waterbody without impairing its designated uses). TMDLs are developed to meet water quality standards. Standards may be expressed as numeric water quality targets or narrative standards for the support of designated uses. The numeric target identifies the specific goals or endpoints for the TMDL that equate to attainment of the water quality standard. The numeric target may be equivalent to a numeric water quality standard where one exists, or it may represent a quantitative interpretation of a narrative standard. This section reviews the water quality standards and identifies an appropriate indicator and numeric target for the calculation of the TMDL for sediment in Lake Creek. This TMDL is developed to meet water quality criteria and protect the uses of Lake Creek described in both state and tribal water quality standards.

2.1. Water Quality Standards

The Coeur d’Alene Tribe has adopted tribal water quality standards for the waters within its Reservation. Both the tribal and state water quality standards contain narrative criteria for the protection of waters from excess sediment.

The tribe’s water quality criteria for sediments are as follows:

> *All surface waters of the tribe shall be free from anthropogenic contaminants that may settle and have a deleterious effect on the aquatic biota or that will significantly alter the physical and chemical properties of the water or the bottom sediments.* (CDAT, 2000)

The state’s water quality criteria for sediments are as follows:

> *Sediment shall not exceed quantities specified in Section 250, or, in the absence of specific sediment criteria, quantities, which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.02.b.* (IDEQ, 2003a)

This TMDL is developed to assure that both these criteria are met and protect the designated uses in Lake Creek. The agencies involved in developing the TMDL (CDAT, USEPA Region 10, Idaho DEQ), have agreed that the interpretation of the narrative criteria used in the TMDL will meet and protect the standards of both the CDAT and the state of Idaho for the affected waterbodies. Designated uses include domestic water supply, agricultural water supply, recreational and cultural use, bull trout aquatic life use (Upper Lake Creek), and cutthroat trout aquatic life use (Lower Lake Creek).

2.2. Parameter of Concern

The 1998 303(d) list of impaired waters identified Lake Creek as water quality limited because of sediment.

2.3. TMDL Endpoints

The TMDL is developed to meet instream TSS limits representing levels acceptable for designated use support.

The TSS limits were established from a range of values typically maintaining good or moderate fisheries (EIFAC, 1965). The European Inland Fisheries Advisory Commission report (EIFAC, 1965) reviewed literature on suspended solids effects on fisheries in an attempt to define water quality criteria for suspended solids and fisheries. The report indicated that a relationship between solids concentration and risk of fisheries damage could not be precisely defined, but the available information could be used to establish categories of risk to fisheries with associated typical ranges of concentrations. Based on the information included in EIFAC (1965), the Environmental Studies Board of the National Academy of Sciences (NAS and NAE, 1973) recommended the following ranges of TSS concentrations and the corresponding effects on aquatic communities:

- <25 mg/L = No harmful effect on fisheries
- 25-80 mg/L = Slight effect on production
- 80-400 mg/L = Significant reduction in fisheries
- >400 mg/L = Poor fisheries

Based on these ranges, a TSS limit of 25 mg/L was selected for flows below 89 cfs and a TSS limit of 40 mg/L was selected for flows above 90 cfs for the mouth of Lake Creek. When examining the flows and the corresponding TSS limits all flow ranges below 50% were meeting the 25 mg/L limit except for two (20 and 50%) with percent reductions of 8 and 11% respectively. The 25mg/L limit was picked to remain protective of cutthroat trout habitat during the summer months and not cause any anti-degradation. Forty mg/L was picked as a limit to strive for during high flow when the majority of the sediment loading takes place, since 40 mg/L of TSS was shown to have only a slight effect on productivity. It's during these flows that trout will be returning to spawn. The ranges identified in EIFAC (1965) and NAS and NAE (1973) represent a persistent instream concentration that occurs frequently, rather than a maximum instantaneous concentration that may occur infrequently and present less of a risk to the aquatic communities.

2.4. Secondary Monitoring Targets

In addition to an instream TSS limit concentration, the Lake Creek TMDL implementation plan will establish monitoring targets for aquatic habitat measures. Because it is difficult to link such water column measurements as TSS to aquatic life habitat quality, measures of channel and habitat conditions are more useful in directly gauging the availability and quality of aquatic life habitat and support. These indicators include measurements such as riffle:pool ratios, channel substrate composition, and amount of large woody debris. If an evaluation of habitat measures indicates that Lake Creek is supporting designated uses prior to meeting load reductions or TSS limits established in the TMDL, the TMDL will be reevaluated and revised accordingly.

The Lake Creek Watershed Assessment (CDAT, 2000) previously evaluated streambank and habitat measures in the Lake Creek watershed. It is expected that additional monitoring of these measures will be conducted to track the improvement of habitat quality in response to the sediment load reductions implemented by this TMDL. Potential habitat measures to be monitored and proposed targets are included in Tables 2-1 and 2-2. The specific targets associated with each habitat measure are proposed and will be further defined in the Lake Creek TMDL implementation plan.

Table 2-1. Proposed Targets for Habitat Indicators

Indicator	Proposed Target	Source
Percent fines (< 4 mm) in channel substrates	No more than 10 percent of particles < 4 mm	CDAT (2000) [Hickman and Raleigh (1982)]
Riffle:pool ratio	1:1	CDAT (2000) [Hickman and Raleigh (1982)]
Residual pool depth	1.0 m	Personal communication, CDAT, July 2003
Riffle stability index	RSI< 70	IDEQ (2003b) [Kappesser (1993)]; CDAT (2000) [Kappesser (1992)]
Fish counts	Phased targets of juvenile fish/m^2 (See Table 2-2)	Personal communication, CDAT, Department of Natural Resources, October 2003
Cobble embeddedness	Targets are not established at this time but will be considered in future monitoring. If future monitoring provides sufficient information on reference levels, quantitative targets will be established at that time.	
Large woody debris		

Table 2-2. Proposed Targets for the Lake Creek Fishery[1]

Segment[2]	Phased Target (juvenile fish/m^2)				
	1998	**2007**	**2012**	**2016**	**Beyond**
Lower Lake Creek	0.020	0.023	0.061	0.069	0.224
Upper Lake Creek	0.128	0.128	0.178	0.283	0.393

1 Personal communication, CDAT, Department of Natural Resources, October 2003.
2 Lower Lake Creek extends from the Emtman gauging station to the mouth. Upper Lake Creek extends from the Emtman gauging station to the headwaters.

3. Data Analysis

Several sources of water quality and watershed information were reviewed to characterize the condition of Lake Creek with respect to sediments and turbidity; however, some data were used for background information and were not used directly in the calculation of the TMDL. This section includes the following information:

- Data inventory describes the available data and information used to evaluate water quality conditions in Lake Creek.
- Data analyses presents results of various data analyses evaluating trends and relationships in instream data.

3.1. Data Inventory

Table 3-1 and the following sections summarize the data and information evaluated.

Table 3-1. Data Available for the Lake Creek Watershed

Date	Source	Relevant Data
Instream monitoring data		
1996–2001	Kootenai-Shoshone Soil Conservation District	Continuous monitoring, including turbidity with some TSS samples. (Majority of these data were collected for and presented in KSSCD [1998])
1997–2002	CDAT	Water quality monitoring data, including TSS and turbidity
1989	STORET (Idaho Department of Health and Welfare)	Turbidity data
Other watershed information		
2000	CDAT draft *Lake Creek Watershed Assessment*	General background, watershed/stream conditions, and sediment loading estimates
1996, 1997	Idaho DEQ	BURP field sheets

Kootenai-Shoshone Soil Conservation District

During the initial stages of the Lake Creek Agricultural Project, the Kootenai-Shoshone Soil and Water Conservation District[2] (KSSWCD) collected water quality and hydrologic data during 1996, 1997, and 1998 at Emtman and Godde stations (Figure 3-1). The Emtman station is located at river mile 7.4, just below the confluence of Lake Creek and Bozard Creek. The Godde station is located at river mile 3.4, 0.75 mile downstream of the Highway 95 bridge.

The monitoring was initiated to evaluate the effectiveness of best management practices (BMPs) planned for the watershed. Data collected from January 1996 through April 1998 are presented in *Lake Creek Agricultural Project: Summary of Baseline Water Quality Data* (KSSCD, 1998) and represent water quality under minimal BMP implementation. KSSWCD discontinued water quality monitoring at the two sites in 2001. Data are available from January 1996 through August 2001.

[2]Kootenai-Shoshone Soil and Water Conservation District was formerly the Kootenai-Shoshone Soil Conservation District (KSSCD).

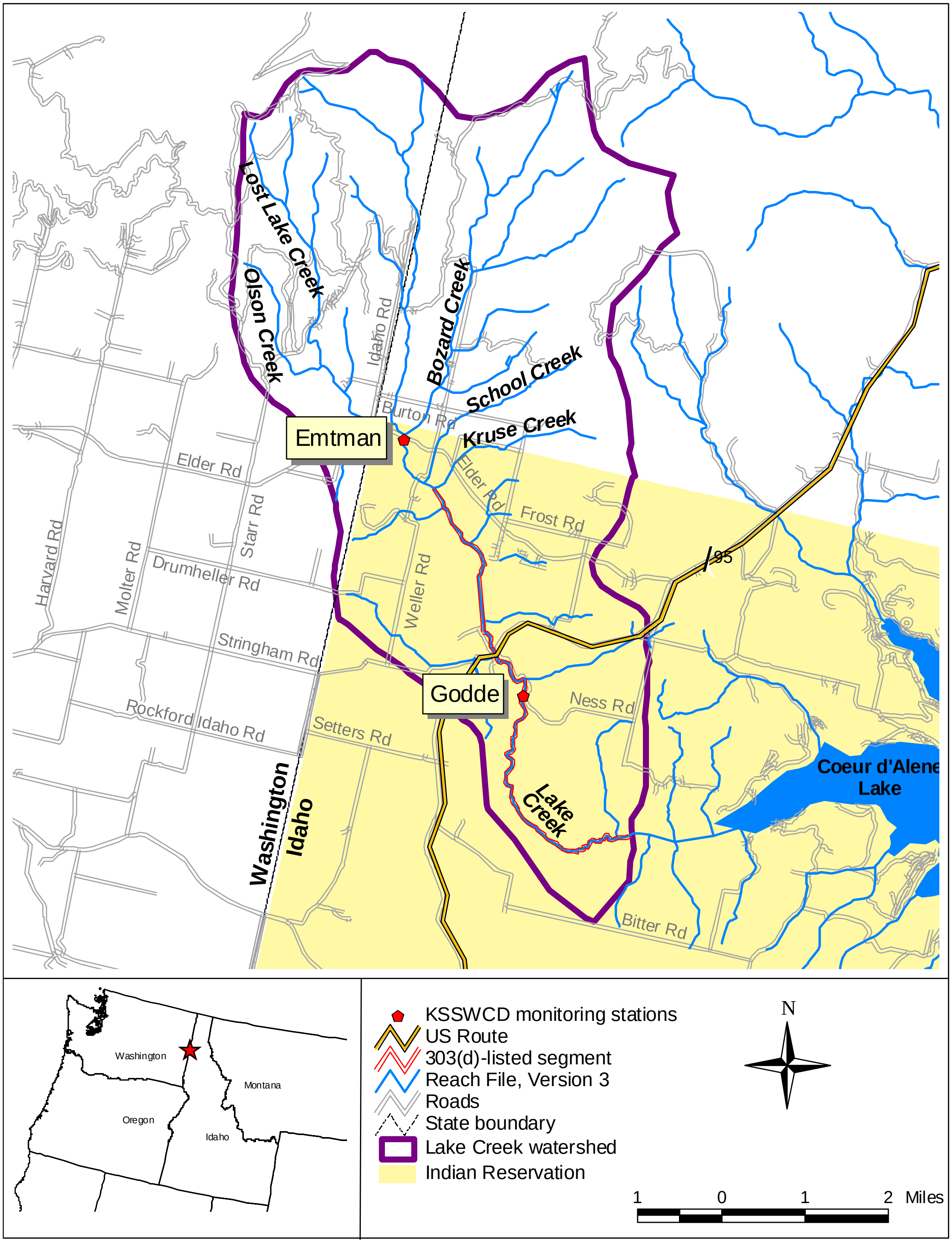


Figure 3-1. Location of KSSWCD monitoring stations on Lake Creek.

The monitoring includes continuous readings of water stage, turbidity, conductivity, and precipitation as well as air, ground, and water temperature. Readings were recorded every 15 minutes and are presented in data files as hourly readings. Turbidity is measured in millivolts using an optical particle sensor and converted to turbidity in nephelometric turbidity units (NTU) based on calibration to laboratory-analyzed turbidity samples. Corresponding continuous flows are also available, recorded as stage heights and converted to flows based on calibration rating curves. Several manual samples were also collected and analyzed for TSS, turbidity, and nutrients to provide data for calibration of field equipment.

Grab Samples

During 1996 KSSWCD collected grab samples at the two Lake Creek stations to provide data for development of calibration curves. KSSWCD collected additional grab samples in 1997 and 1998. Table 3-2 provides a summary of data collected manually by KSSWCD at the Emtman and Godde stations, and Figures 3-2 and 3-3 present the values grouped by month. As shown in Figures 3-2 and 3-3, sampling occurred mainly in February and March, with no data collected between May and October.

Table 3-2. Summary of KSSWCD Grab Samples Collected at the Emtman and Godde Stations

	Emtman Station		Godde Station	
	TSS (mg/L)	Turbidity (NTU)	TSS (mg/L)	Turbidity (NTU)
Minimum	3.00	6.00	2.90	8.00
Maximum	330.00	360.00	1,450.00	1,020.00
Average	105.76	67.41	327.35	183.92
Start date	2/1/96	2/1/96	1/18/96	1/18/96
End date	3/2/98	3/2/98	3/2/98	3/2/98
Number of samples	26	23	36	36

Continuous Samples

KSSWCD has conducted continuous monitoring of water stage, turbidity, conductivity, and precipitation as well as air, ground, and water temperature at the Emtman and Godde stations on Lake Creek since 1996. Automated readings were recorded every 15 minutes and are presented in data files as hourly values. Average daily turbidity values were calculated for every day sampled in the period of record at the two stations, using the hourly data. Table 3-3 provides a summary of the daily average turbidity values over the period of record for both the Emtman and Godde stations.

Table 3-3. Summary of Daily Average Turbidity Readings at KSSWCD's Emtman and Godde Sites

	Turbidity (NTU)	
	Emtman Station	Godde Station
Minimum	3	1
Maximum	145	2,161
Average	19	113
Start date	2/4/96	1/16/96
End date	4/30/00	8/31/01
Number of samples	731	1,314

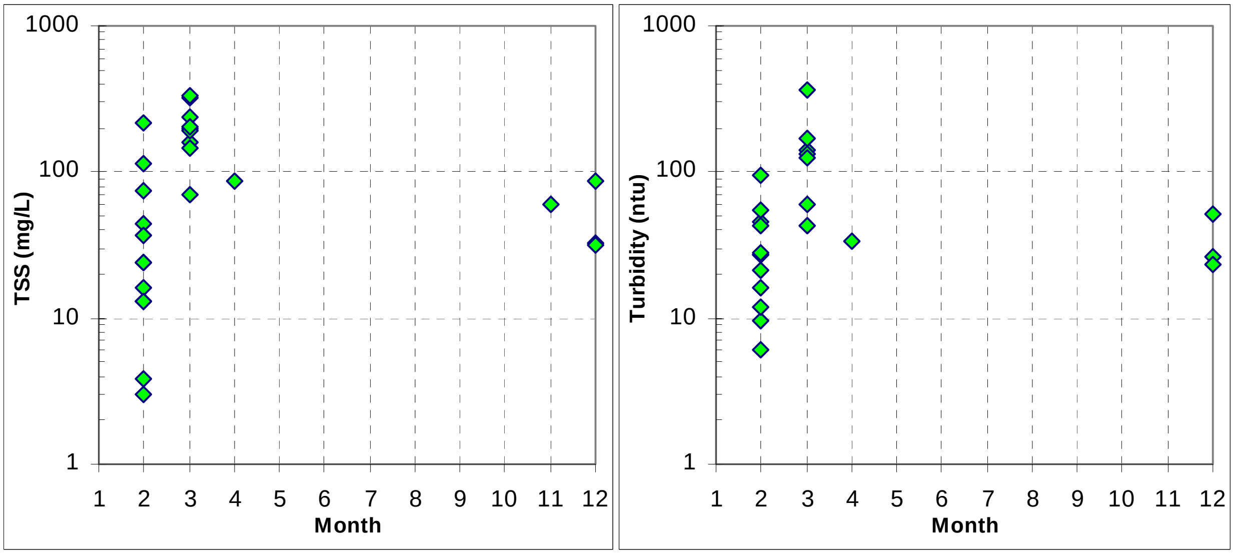


Figure 3-2. Monthly distribution of TSS and turbidity data collected by KSSWCD at the Emtman site from Feb. 96-March 98.

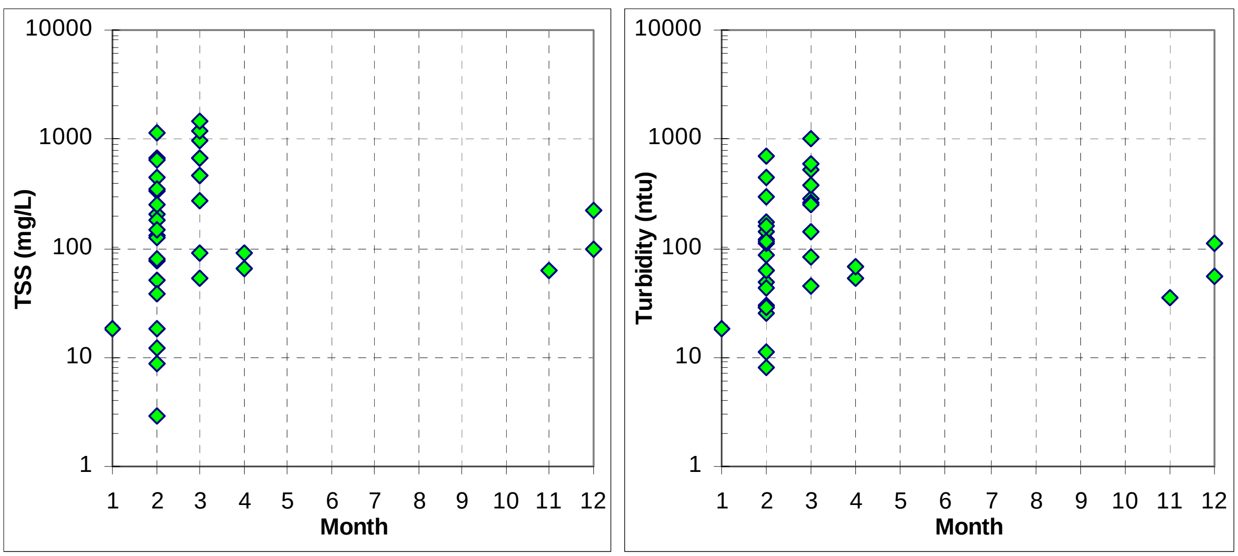


Figure 3-3. Monthly distribution of TSS and turbidity data collected by KSSWCD at the Godde site from Jan. 96–March 98.

Coeur d'Alene Tribe

The CDAT has collected several grab samples in the Lake Creek watershed. They have monitored the Lower Lake Creek station (Godde) since 1997 and have since begun sampling at the Upper Lake Creek station (Emtman) and on Bozard Creek. Table 3-4 provides a summary of these data. These data were combined with KSSWCD manual samples to establish a relationship between TSS and turbidity for use in the TMDL analysis.

Table 3-4. Summary of CDAT TSS and Turbidity Data

Station	Start Date	End Date	Count	Minimum	Average	Maximum
TSS						
Lower Lake Creek	6/30/97	9/10/02	32	2	16.1	154
Upper Lake Creek	2/23/01	2/22/02	6	2	12.5	35.8
Bozard	4/29/98	9/10/02	28	2	5.5	20
Turbidity						
Lower Lake Creek	4/29/98	9/10/02	32	0.961	8.6	76.8
Upper Lake Creek	2/23/01	2/22/02	6	3.12	10.4	21.3
Bozard	3/17/99	9/10/02	28	0.994	4.1	13.6

STORET

USEPA's STORET database was searched for water quality data for Lake Creek. No turbidity, TSS, or sediment data were available in STORET for the Lake Creek watershed in the last 10 years. However, turbidity data were collected by the Idaho Department of Health and Welfare at 14 stations throughout the watershed from January through November 1989. Given the availability of a more recent and robust data set (i.e., continuous monitoring by the KSSWCD), these data were not used in the TMDL analysis.

Coeur d'Alene Tribe Watershed Assessment

The Coeur d'Alene Tribe's Water Resource Program developed the draft *Lake Creek Watershed Assessment* (CDAT, 2000) in July 2000. The report provides background on the watershed's physiographic setting; information on stream hydrology, streambank and streambed conditions, and water quality; and estimates of watershed sediment loading. This section summarizes the information in CDAT (2000) related to the instream conditions in Lake Creek and the impairment to designated uses by sediment.

In 1993 and 1994, the tribe conducted channel and habitat surveys in Lake Creek. A study of Lake Creek's channel morphology indicated that sediment inputs to Lake Creek will likely be deposited within the channel and will not be transported under the majority of stream flows. Based on this and the sediment budget results, the assessment indicates that the present response of Lake Creek to sediment loading is the aggradation of fine sediment and a decrease in salmonid spawning conditions.

The watershed assessment evaluated indicators of aquatic habitat related to the composition of the channel substrate, as well as the presence and measure of pools and riffles in the stream. Because fine sediments can fill interstitial gravel spaces or bind with other sediments to create a hard surface that prevents egg laying and brooding, measures of sediment size distribution can indicate the quality of salmonid habitat. CDAT (2000) identifies optimal cutthroat trout habitat as less than 10 percent of the particles being smaller than 4 millimeters (mm) in size. The lower reaches of Lake Creek generally had less than 20 percent of particles smaller than 4 mm (but greater than the 10 percent criteria). Percentage of particles smaller than 4 mm was generally greater than 30 percent in the middle reaches. No assessment of the upper forested reaches was conducted. Based on the 1993 and 1994 surveys, four of the nine surveyed reaches had good pool habitat frequency. Average riffle:pool ratios were 2.7:1 in 1993 and 2.8:1 in 1994. None of the surveyed reaches attained the 1:1 ratio identified as optimum. The optimum residual pool depth for salmonid habitat is identified as 2.0 meters. Average residual pool depth for Lake Creek was 0.5 meter, with no individual pool measurements meeting the 2.0-meter criteria.

Channel stability was also estimated for Lake Creek, using the channel stability index of Pfankuch (1975). The index is based on scores for a variety of stability factors, including mass wasting potential, debris jam potential, bank vegetation density, channel capacity, in-channel erosion and deposition, and bottom substrates. Most of the ratings for Lake Creek and West Lake Creek were fair, with reaches not meeting good or excellent ratings because of observed bank cutting and lack of bank vegetation.

The Riffle Armor Stability Index (RASI) was measured at seven reaches in Lake Creek and West Lake Creek to evaluate the stream stability. The evaluation resulted in 37 RASI scores, including the following:

- 20 scores indicating that the system is entering a period of instability (70-90)
- 13 scores indicating geomorphic stability (<70)
- 4 scores indicating instability

The tribe's watershed assessment also included electrofishing surveys in an attempt to quantify the populations, age distributions, and habitat of salmonids in Lake Creek. Based on the data, the cutthroat trout population in the Lake Creek drainage is estimated at 1,457. Fish density measured during the survey ranged from 0.3 to 18.2 fish/100 m^2. Fisheries data indicate that cutthroat spawning activity occurs in the Lake Creek mainstem and the upper tributaries.

Beneficial Use Reconnaissance Project

Idaho DEQ conducted biological assessments of fish habitat at two sites in 1996. The upper site coincides with KSSWCD's Emtman monitoring station. The lower site is 1.25 miles upstream from the stream mouth and 0.75 mile downstream of KSSWCD's Godde monitoring site. A 1997 survey was conducted at a third site, 200 meters below Elder Road bridge, near KSSWCD's Emtman monitoring station. During these surveys, widths, depths, and bank stability were measured and Wolman pebble counts were conducted. This section summarizes information contained on the Beneficial Use Reconnaissance Project field forms.

Streambanks with higher percentages of rooted vegetation and overhead cover can resist erosion and can provide stable pools for fish habitat. The 1997 survey of Lake Creek found 95 percent of the streambank to be covered and stable and 5 percent to be covered but unstable. These findings agree with those of the 1996 survey, which rated the upper streambanks as 95 to 97 percent covered and stable and the lower site streambanks as 92 to 97 percent covered and stable. This level of covered, stable streambank would significantly reduce sediment loss through streambank erosion.

Sediment size distribution is a measure used to evaluate the condition of aquatic habitat. Fine sediments can fill interstitial gravel spaces or bind with other sediments to create a hard surface that prevents egg laying and brooding. The *Lake Creek Watershed Assessment* report (CDAT, 2000) defined optimal cutthroat trout habitat as 10 percent of particles below 4 mm in size. This target value was used to assess the particle counts from the Idaho DEQ surveys. In 1996 the upper site had one riffle, while the lower site had two riffles where pebble counts were performed. The 1996 results are summarized in Table 3-5. Neither the upper nor lower site meets the targets from the *Lake Creek Watershed Assessment* report. By 1997 Idaho DEQ was using a modified pebble count procedure. The modified procedure divides each site into a wetted zone and outside the wetted zone. For each site, the 1996 pebble counts by particle size were similar to the 1997 totals (wetted zone plus outside wetted zone counts) for the corresponding particle size.

Another assessment metric is the quantity and quality of pools that provide habitat for fish and other aquatic life. Pool quantity and quality are evaluated in several ways, including percent pools, riffle:pool ratio, and pool depth. The 1996 survey found that the upper site was 43 percent pools and the lower site was 14 percent pools. The optimal riffle:pool ratio identified by CDAT (2000) is 1:1. The upper site had 4 meters in riffles and 49 meters in pools, resulting in a ratio of 0.08:1, and the lower site had 35 meters in riffles and 21 meters in pools, with a ratio of 1.7:1. CDAT (2000) identified optimal residual pool depth as 2 meters. Maximum residual pool depths measured in 1996 were 0.45 meter at both the upper and lower sites.

Table 3-5. Pebble Counts for 1996 Beneficial Use Reconnaissance Project

Size (mm)	Upper Riffle Count	Upper Riffle Percent	Lower Riffle 1 Count	Lower Riffle 1 Percent	Lower Riffle 2 Count	Lower Riffle 2 Percent	Lower Riffles Mean	Lower Mean Percent
0–1	8	11.1	15	25.4	15	24.6	15	25.0
1–2.5	21	29.2	1	1.7	1	1.6	1	1.7
2.5–6	0	0.0	1	1.7	0	0.0	0.5	0.8
6–15	5	6.9	0	0.0	1	1.7	0.5	0.8
15–31	12	16.7	2	3.3	1	3.3	1.5	3.3
31–64	22	30.6	5	8.5	13	21.3	9	15.0
64–128	2	2.8	9	15.3	18	29.5	13.5	22.5
128–256	2	2.8	18	30.6	10	16.4	14	23.3
256–512	0	0.0	5	8.5	2	3.3	3.5	5.8
512–1,024	0	0.0	2	3.4	0	0.0	1	1.7
1,024+	0	0.0	1	1.7	0	0.0	0.5	0.8
Total	72	100.0	59	100.0	61	100.0	60	100.0

3.2. Data Analysis

To better understand water quality and flow conditions in Lake Creek, various data analyses were conducted to identify trends and relationships in instream data. The following sections summarize the results of these analyses, including a comparison of observed TSS values to the TMDL target, an evaluation of the relationship between instream sediment measures (i.e., TSS and turbidity), an evaluation of temporal water quality and flow trends, and an evaluation of spatial variations in water quality.

Relationship Between Instream TSS and Turbidity

Local TSS data provide a measure of the amount of sediment suspended in the stream at a given moment in time. However, instream TSS data are limited, whereas turbidity data have been available almost daily since 1996 and for a wider range of flows. Therefore, turbidity and TSS data were evaluated to identify a relationship between the two parameters. If a relationship exists, turbidity data can be used to indirectly evaluate instream TSS trends or relationships that could not be conducted with the limited TSS data set.

Both TSS and turbidity provide measures of the amount of sediment in the stream. Turbidity is an optical measure of water related to light transmission and is a measure of the total amount of light-scattering particles in a water sample. TSS refers to solids that are not in true solution and can be removed by filtration. TSS accounts for both organic and mineral particles. Such suspended solids typically contribute to the turbidity of the water column.

Turbidity and flow data were collected in Lake Creek during KSSWCD's long-term monitoring program beginning in 1996, and TSS data are available sporadically throughout the period of record. In addition, the CDAT has collected turbidity and TSS data at three watershed stations. The paired TSS and turbidity data available from KSSWCD and the CDAT were used to establish a relationship between the two parameters. That relationship is illustrated in Figure 3-4 and is represented by the equation in Figure 3-4.

Because of the availability of continuous turbidity measurements and the strong correlation between turbidity and TSS, the turbidity data set was evaluated to gain an understanding of temporal and spatial patterns in TSS conditions, as discussed in the following sections.

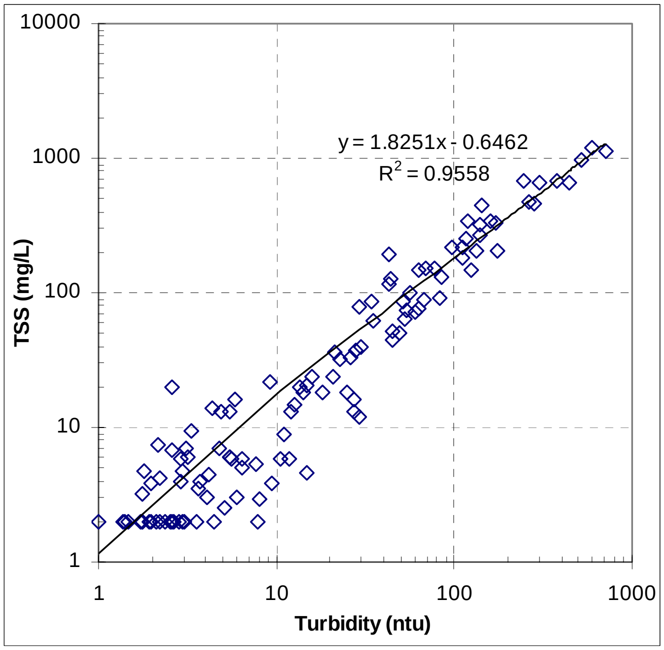


Figure 3-4. TSS (Jan. 96-Sept. 02) versus turbidity (Jan. 96-Sept. 02) for Lake Creek monitoring data.

Comparison of TSS to TMDL Target

Available TSS data were compared to the TMDL limits of 25 and 40 mg/L to evaluate the magnitude of deviation of current water quality conditions from desired conditions. Table 3-6 summarizes the data, and Figure 3-5 presents the observed data in comparison to the TMDL target. Because the recent TSS data available are limited, KSSWCD continuous turbidity data were converted to TSS values based on the TSS-turbidity correlation for comparison to the TMDL TSS target. Evaluation of the converted TSS values against the TMDL target is summarized in Table 3-6 and Figure 3-6.

Table 3-6. Summary of TSS Data Exceeding the TMDL Limits (25 & 40 mg/L)

Station	Data Source	Number of Samples	Exceedances		Percent Exceeding	
Observed TSS			Between 25-40 mg/L	Greater than 40 mg/L	Between 25-40 mg/L	Greater than 40 mg/L
Lower (Godde)	KSSWCD	36	1	30	2.7	83
Upper (Emtman)	KSSWCD	26	3	16	11.5	61
Bozard	CDAT	28	0	0	0	0
Lower	CDAT	32	0	3	0	9.4
Upper	CDAT	6	1	0	16.1	0
Converted TSS						
Upper (Emtman)	KSSWCD	1,005	651	232	65	23
Lower (Godde)	KSSWCD	1,310	217	1,016	16.6	78

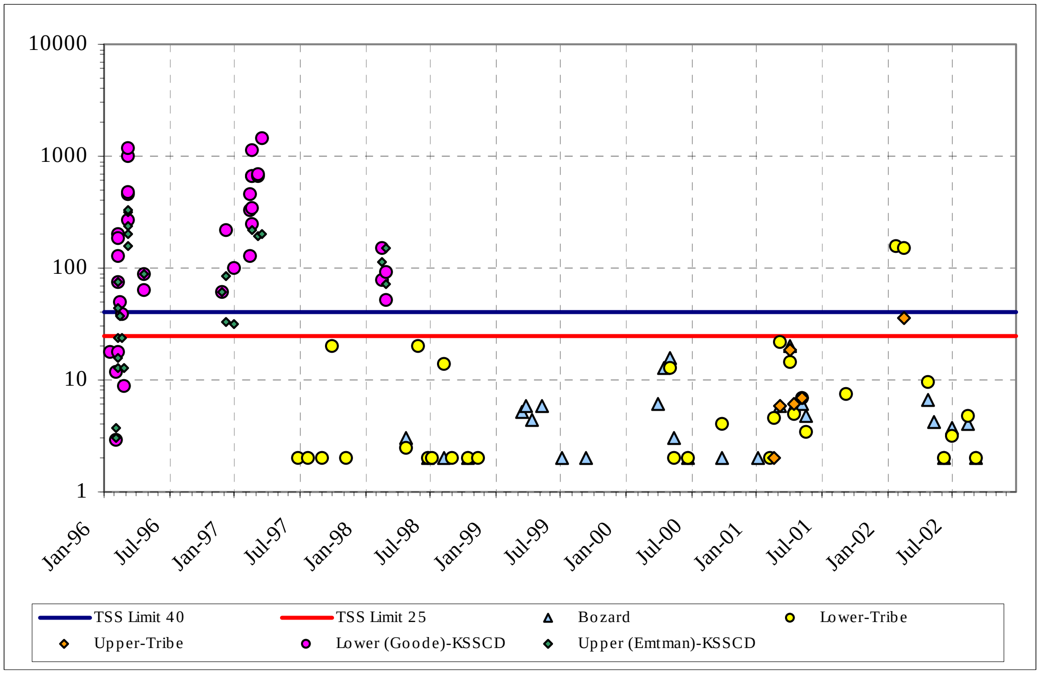


Figure 3-5. Comparison of observed TSS data to TMDL target from Jan. 96-Sept. 02.

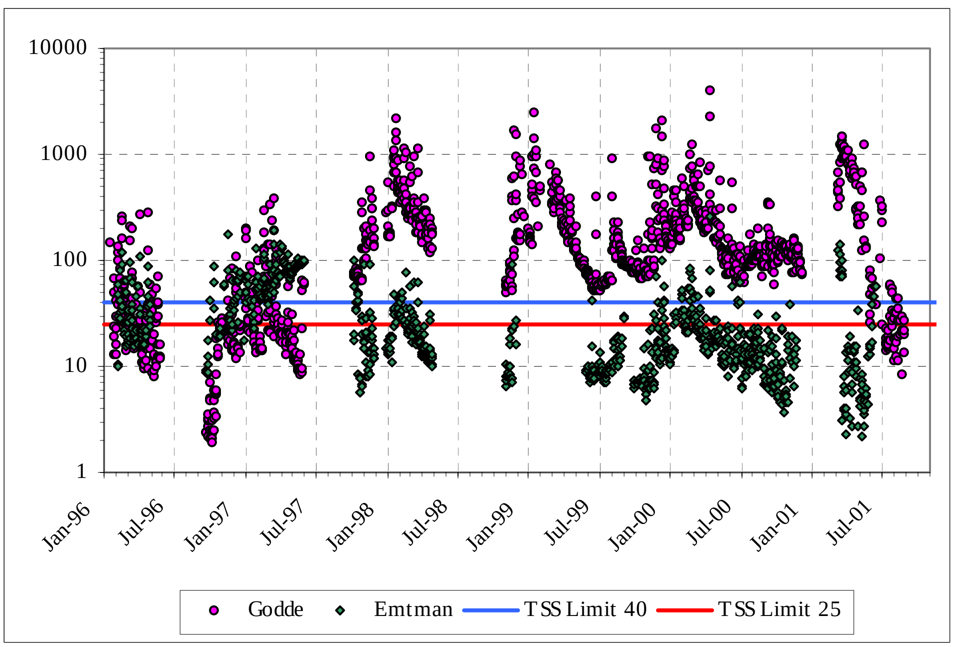


Figure 3-6. Comparison of converted TSS data to TMDL target Jan. 96-Sept. 01).

Spatial Variation

Evaluating the spatial variations in instream turbidity can also help to identify areas of increased sediment loading and the location of potential sources. Figure 3-7 presents turbidity data collected at the Emtman (upstream) and Godde (downstream) stations throughout the period of record. As shown in Figure 3-1, the Emtman station is located on Lake Creek at river mile 7.4, just downstream of the confluence of Lake Creek and Bozard Creek, and the Godde station is located at river mile 3.4, about 2 miles upstream of where Lake Creek enters Windy Bay. Turbidity data collected during 1996 and 1997 are relatively consistent between the two stations. However, from mid-1997 through 2000, turbidity levels at the downstream Godde station are much higher than those recorded at the Emtman station. Because flows during this time remained comparable between the two stations (Figure 3-8), the increased turbidity downstream indicates a new source of sediment or increased source activity between the stations. Investigation of the discrepancies between the stations and their consideration in the TMDL analysis is discussed in later sections.

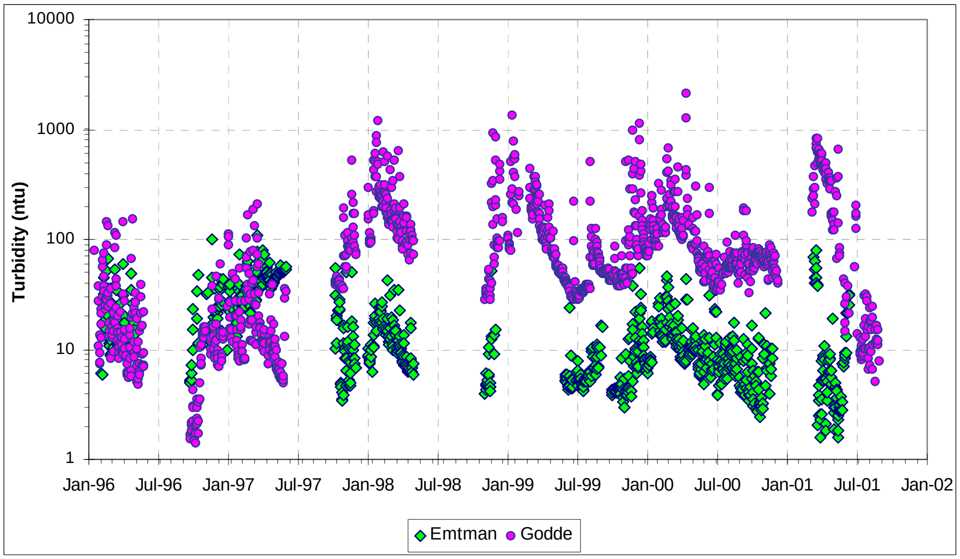


Figure 3-7. Turbidity at Emtman and Godde stations (Jan96-Aug.01).

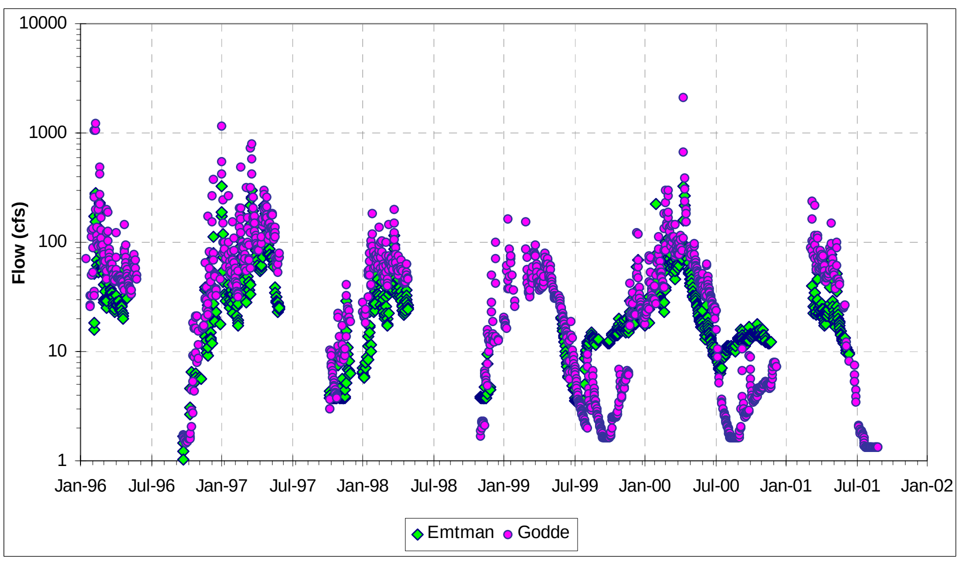


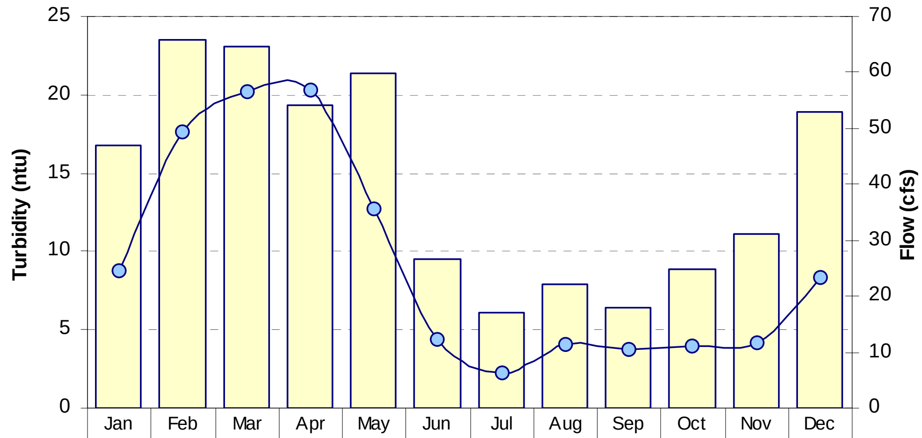
Figure 3-8. Flow at Emtman and Godde stations (Jan96-Aug.01).

Temporal Variation

Temporal variations (e.g., monthly, seasonally) in instream conditions can provide insight into the types of sources contributing to the sediment impairment and the periods of loading and impairment. Monthly or seasonal variations in turbidity can also be due to variations in weather patterns rather than in source activity and sediment loading. Flow and turbidity at the Lake Creek stations were used to evaluate any identifiable patterns in turbidity and between turbidity and flow. Evaluation of relationships between instream flow and turbidity can indicate conditions under which loading and impairment occur. The continuous flow data collected by KSSWCD provide a robust set of turbidity and associated flow data. Figures 3-9 and 3-10 present monthly average flow and turbidity over the period of record at Emtman and Godde stations. Typically, turbidity levels, as well as flows, are higher between November and April. Flow and turbidity tend to follow similar patterns, with higher turbidity during times of higher flow; however, as shown in Figures 3-11 and 3-12, the relationship between flow and turbidity is not strong. (Figures 3-9 through 3-12 represent data only from days with observations of both turbidity and flow.)

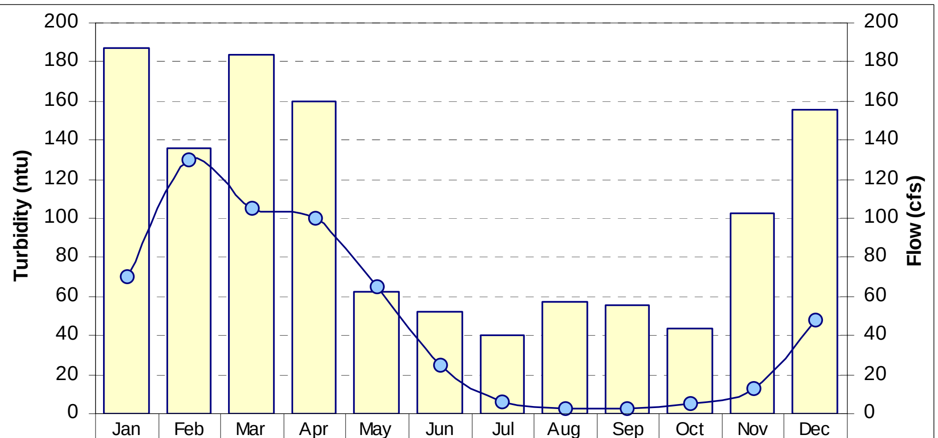
Figures 3-11 and 3-12 include paired flow and turbidity data over the entire period of record at the Lake Creek stations. However, as noted in the previous section, turbidity concentrations at Godde dramatically increased in mid-1997 through 2000, while flow remained comparable throughout the period of record. Figure 3-13 isolates the data before and after the turbidity increase and after June 2001, when turbidity concentrations appear to be returning to lower levels, in an attempt to establish a relationship between turbidity and flow during periods of similar water quality. As shown in Figure 3-13, there is not a strong correlation between flow and turbidity during any of the isolated time periods, reinforcing the assumption that the relationship between flow and turbidity is not strong in Lake Creek.

Because of the hydrologic and climatic patterns of the Lake Creek watershed, it is difficult to directly relate flow and turbidity. Sediment loading and therefore instream turbidity levels likely increase when flows increase as a result of storm events. However, when storms occur as rain-on-snow events, the sediment loading is low related to discharge because the soils are frozen and the ground is covered, and somewhat protected, by snow. In these cases, flow increases with a minimal increase in turbidity. Spring storms could occur when soils have begun to thaw and do not have a protective snow cover, providing the opportunity for erosion and sediment transport to streams, resulting in elevated instream turbidity levels. Therefore, although higher flows typically indicate the occurrence of higher instream sediment and turbidity, not all storm events are conducive to sediment delivery, making it difficult to establish a strong relationship between flow and turbidity.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average turbidity	17	23	23	19	21	10	6	8	6	9	11	19
Average flow	24	49	56	57	36	12	6	11	10	11	12	23
No. of samples	1323	2300	3285	3290	1867	1306	1261	933	865	1988	2462	1100

Figure 3-9. Monthly average flow and turbidity at Emtman station (March96-June01).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average turbidity	188	136	183	160	62	52	40	57	55	43	103	155
Average flow	70	130	105	100	65	24	6	2	2	5	13	48
No. of samples	115	110	175	156	132	67	77	87	66	117	134	74

Figure 3-10. Monthly average flow and turbidity at Godde station (Jan96-Aug01).

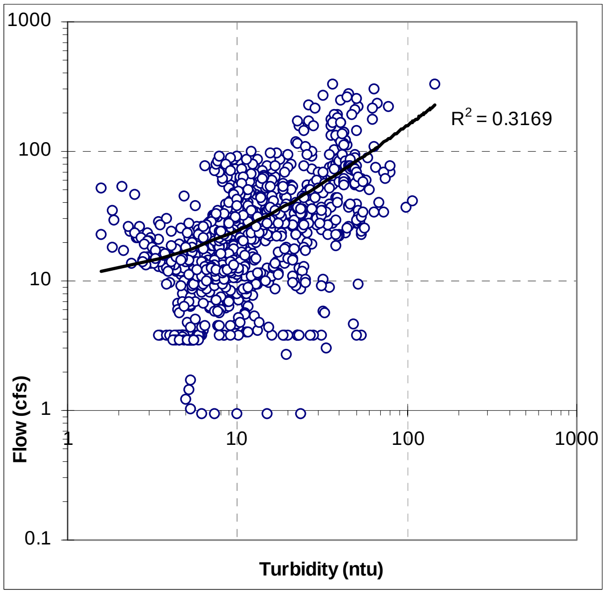


Figure 3-11. Turbidity versus flow at the Emtman site March96-June01).

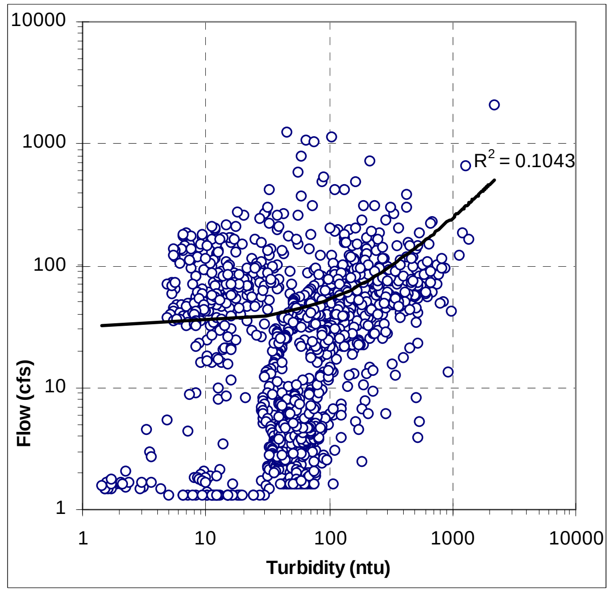


Figure 3-12. Turbidity versus flow at the Godde site (Jan96-Aug01).

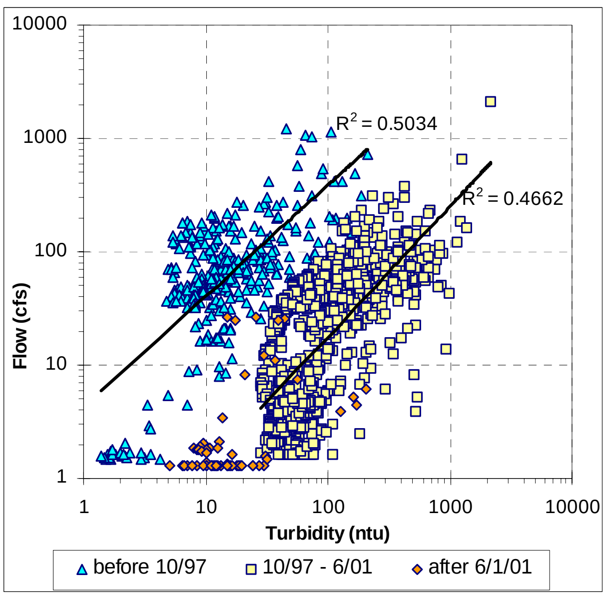


Figure 3-13. Turbidity versus flow at the Godde site—various time periods (Jan96-Aug.01).

4. Pollutant Sources

This section discusses the potential sources of sediment loading to Lake Creek, including point and nonpoint sources.

4.1. Point Sources

Idaho Transportation Department is the only permitted point source. They are regulated by there NPDES permit during the construction phase of the Highway 95 realignment project. Construction on the realignment started in April of 2004. ITD is currently working on phase I, which parallels the Godde tributary that drains to Lake Creek. Starting in April of 2005 they will start the temporary crossings over Lake Creek to construct the Lake Creek bridge. ITD requested a WLA during the construction and post construction activities. The CDAT, EPA and ITD worked together to determine a WLA that Lake Creek could receive and would be protective of the fisheries. Section 6.2 and appendix B describe how the WLA was determined for ITD.

Construction for the new 4 lane divided highway is broken into phases within three construction seasons starting at Fighting Creek and ending just south of Setters. All earth disturbing activities shall be discontinued through the winter shutdown period from October 15th through April 15th. Only bridge construction activities that will not result in erosion or sedimentation will be allowed during the winter shutdown period.

Sediment from the construction site has the potential to affect mainstem Lake Creek as they install culverts to build a temporary crossing while they construct the permanent bridge over Lake Creek. Construction from the Alexander McDowell Rest Area to Lake Creek parallels the Godde tributary that feeds into Lake Creek. This watershed is very flashy during the winter months. ITD has four culvert crossings that are being installed in this watershed. Each one has the potential to contribute sediment to this tributary and then to Lake Creek.

4.2. Nonpoint and Natural Sources

The CDAT Water Resource Program produced a watershed assessment report (CDAT, 2000) that estimated contributions from the various nonpoint sources of sediments in the Lake Creek basin. The sediment loading was calculated using accepted practices from the Washington Forest Practices Board (WFPB, 1997) to account for the major contributing sources. The watershed assessment identified gully erosion, roads, soil creep, erosion from cropland, and mass movement of soils as the major sources of sediment in the Lake Creek watershed. The following source summaries are based on information in CDAT (2000).

Soils in the Lake Creek watershed fall mainly into three general categories:

1. Alluvial soils in lowlands. These soils are usually found on 0 to 2 percent slopes and have a low erosion potential.
2. Loess-derived soils on lower elevation hills. These soils are usually found on 3 to 25 percent slopes and have a moderate to high erosion potential.
3. Colluvial and residual soils. These soils are usually found on 5 to 65 percent slopes and have a high to very high erosion potential.

The loess-based soils and colluvial soils are frequently underlain by an impermeable layer that results in 97 percent of cropland in the Idaho portion of the basin being highly erodible (KSSCD, 1991). Two methods are usually used to estimate the amount of sediment available for movement in the watershed the yield approach and the budget approach. The yield approach is based on sediment passing a monitoring station, which would not account for sediment storage in the stream, also called aggradation. Aggradation typically has a negative impact on cold water biota and lengthens the recovery time of a stream. For shallow stream sections, the sandbars show the instream sediment storage, which is subject to transport when the water velocity increases. In deeper sections, the impact of aggradation is not seen until the pools fill with sediment or stream measurements reveal the habitat changes. On the other hand, the budget approach accounts for the total sediment loading from the different sources and estimates the percentage of the different loadings that is likely to be transported to the stream.

The CDAT conducted a sediment budget in the Lake Creek watershed (CDAT, 2000), including measurements and estimates for soil creep, mass wasting, sheet and rill erosion, gully erosion, and road erosion. Sediment exiting the system was estimated using established sediment budget research and limited yield data from the Lake Creek watershed. Soil creep and mass wasting provide an estimate of the natural sedimentation in the absence of soil and vegetation disturbances. Information in the following sections is based on this sediment budget and is provided to identify possible sources of sediment in the Lake Creek watershed and their relative magnitude.

Soil Creep

The effects of gravity result in the gradual movement, or creep, of soil down a slope, even in the absence of water. This movement is difficult to measure, but its effects can be readily observed in the tilt of telephone poles and curved tree trunks on hillsides. Increased slope and soil depth generally produce a higher creep rate. Soil creep terminates at the stream, so the delivery ratio for soil creep is 100 percent. Using the estimation methods of the WFPB (1997), the CDAT estimated a soil creep loading of 709 tons/year of sediment.

Mass Wasting

Mass wasting, or mass movement, is the rapid movement of soil from one location to another. The instability resulting in the movement is frequently caused by water. Mudslides and landslides are large-scale mass wasting events. The mass wasting load includes the effect of saturated and unsaturated soil movement. When saturated sediment at the head of a channel detaches, the sediment flows through the channel. As a result, portions of the channel are filled and a new channel forms. These are usually single episode events that happen intermittently. The unsaturated soil movement is characterized by sediment masses that detach multiple times during the period of instability. The soil movements rarely result in new channels and are the result of undercutting of slopes, low-level seismic activity, or multiple years of higher-than-normal precipitation.

The soil loss from mass wasting was developed using approved methods from Ritter et al. (1995). The surface area of the soil slides was used to estimate the soil volume. This volume in cubic yards was converted to cubic feet, and multiplied by a conservative soil density of 100 pounds per cubic feet to obtain a weight. Based on estimated tree ages, the recurrence interval for the slides is 50 years. This gave an average annual input of 14,000 tons/year. By multiplying the 14,000 tons/year by the relief ratio, or average slope, of 0.06, the estimated loading is 840 tons/year.

Road Systems

Contributions of sediment from roads (especially unimproved roads) are a significant component of sediment budgets. Sediment loads were estimated using the methods of WFPB (1997) and total road mileage in the tribe's geographic information system (GIS) database. The major factors for the sediment loading are vegetation, road surface, travel frequency, and total mileage by road type. Four road types were used to derive a total loading of 5,600 tons/year and a stream delivery of 336 tons/year based on average slope. The four road types and their estimated sediment loads are shown in Table 4-1.

Table 4-1. Sediment Loadings from Road Surfaces

Road Type	Total Load (tons/yr)	Stream Load (tons/yr)
4-wheel drive roads	4,180	251
Secondary roads	880	53
Main roads (Hwy 95)	350	21
Gravel improved roads	188	11

Ephemeral Gully Erosion

Ephemeral gully erosion is the ongoing process by which ditches and gullies become deeper and wider with rainfall. Gully erosion was estimated from direct measurements at several sites. The sites provided a mix of slopes, uses, and direction of the slope faces (aspect). Field measurements were entered into a spreadsheet designed for the Soil Conservation Service (SCS) gully measurement approach (KSSCD 1991), resulting in an average erosion of 1.42 tons/acre or 12,100 tons from 8,518 acres susceptible to gully erosion. Applying the relief ratio of 0.06 yields a stream delivery rate of 726 tons/year.

Sheet and Rill Erosion from Cropland

Rill erosion is the result of water contained in many small channels. These are the miniature gullies found in a field, which will become gullies if not corrected. When a sheet of water flows across the land surface, unattached soil is transported, resulting in sheet erosion. Using the Revised Universal Soil Loss Equation (RUSLE) sheet and rill erosion was estimated in KSSCD (1991). The equation considers topography, climate, crop type, and soil types. The 1991 estimates were not expected to change significantly in the past decade. Estimates were derived for three units: crops in flat bottoms with 0 to 2 percent slopes, crops on 3 to 7 percent slopes, and crops on 3 to 25 percent slopes. The total loading was 115,070 tons/year, with 10,615 tons/year reaching the stream. The estimated sediment loading from croplands is summarized in Table 4-2.

Table 4-2. Erosion from Croplands

Unit	Slope	Acres	Yield (tons/ac)	Total Load (tons/yr)	Delivery Ratio	Stream Load (tons/yr)
1	0–2%	276	4.8	1,370	20%	265
2	3–7%	2,060	9.9	20,400	5%	1,020
3	3–25%	6,182	15.1	93,300	10%	9,330
Total				115,070		10,615

Streambank Erosion

The tribe was not able to estimate the streambank erosion in their sediment budget, but field work in the basin did include notes about freshly cut banks. The WFPB methods for estimating streambank erosion use aerial photos or actual measurements. Lake Creek is too small for the aerial photo method, and the available time and resources did not allow for actual measurements.

Sediment Yield

Using the best available information and methods, the tribe developed estimates of the total sediment generated in the watershed and the loadings reaching the stream. The agricultural contribution is the predominant source, both in generation and delivery. The yield for each component is summarized in Table 4-3.

Not all the 13,226 tons/year of sediment reaching the stream will be transported out of the watershed. The sediment retained by the stream fills the slower backwaters to create new stream channels, sandbars or mudflats, and streambanks, thereby reducing the available fishery habitat. Some of the sediment also settles onto the stream channel, filling the interstitial spaces in the gravel or binding to the sediments to form a hard crust. A hardened stream bottom and the loss of interstitial spaces would affect the Lake Creek designated use of salmonid spawning. In studies that were conducted in 1990 and 1998 a sediment-discharge relationship was never completed therefore making it difficult to do a calculation of yield. Accordingly, the generation of a sediment-discharge relationship requires depth-integrated sampling of total suspended sediment across the velocity profile under a variety of discharge conditions (Meade et al., 1990). There was no data available at the time that the lake creek watershed assessment was written. The Coeur d'Alene Tribe also tried to conduct back-calculating from the lake, which is complicated by scour losses and autochthonous inputs. Four sediment cores were taken from Windy Bay by (Eylar, 1990) but one of the cores was missing the Mount St. Helens ash layer used as the time marker for the other three, indicating that scour losses do occur within the bay. The Coeur d'Alene Tribe's report cites sources that show that forested and agricultural watersheds generally export 5 to 20 percent of the generated sediments. Other studies cited in the report found that 50 percent of annual sediment yields result from three or four runoff events, and 90% delivered by 10% of the annual discharge. Based on these studies, the limited sediment discharge information available, and graphical relationships of percent yield to basin area, the tribe estimated the yearly export to be approximately 11 percent, or 1,455 tons/year (CDAT, 2000).

Table 4-3. Summary of Sediment Loadings

Source	Total Load (tons/yr)	Stream Load (tons/yr)	Percent of Total
Soil creep	1,050	709	5.4
Mass wasting	14,000	840	6.4
Road system	5,600	336	2.5
Crop land erosion	115,070	10,615	80.3
Gully erosion	12,100	726	5.5
Total	147,820	13,226	100.0

As discussed in the following sections, existing monitoring data are used to establish the existing sediment loadings and loading capacity for the Lake Creek watershed, rather than the tribe's sediment budget. Instream observed data provide a direct measurement of the water quality conditions of the stream and tie sediment loading directly to instream conditions, which ultimately measure impairment. The tribe's sediment budget provides useful insight into the categories of nonpoint sediment sources and illustrates the relative magnitudes of the sources. The sediment budget will be helpful in prioritizing control efforts and focusing source reductions, but because it does not provide a link to the instream conditions, it was not used in the TMDL analysis.

5. Analytical Approach

Developing TMDLs requires a combination of technical analysis, practical understanding of important watershed processes, and interpretation of watershed loadings and receiving water responses to those loadings. In identifying the technical approach for development of the sediment TMDL for Lake Creek, the following core set of principles was identified and applied:

- ***The TMDLs must be based on scientific analysis and reasonable and acceptable assumptions.*** All major assumptions have been made based on available data and in consultation with appropriate agency staff.
- ***The TMDLs must use the best available data.*** All available data in the watershed were reviewed and were used in the analysis where possible or appropriate.
- ***Methods should be clear and as simple as possible to facilitate explanation to stakeholders.*** All methods and major assumptions used in the analysis are described. The TMDL document has been presented in a format accessible to a wide range of audiences, including the public and interested stakeholders.

The analytical approach used to estimate the loading capacity, existing loads, and load allocations presented below relies on these principles and provides a TMDL calculation that uses the best available information to represent watershed and instream processes.

5.1. Analysis Background

Instream solids concentrations are highly variable based on flow and antecedent conditions, and instream flows vary depending on weather and watershed conditions. To capture the inherent variability of flow and instream sediment conditions in Lake Creek, this TMDL uses observed flow data and a TSS target to statistically establish loading capacities for various flow ranges in Lake Creek.

Observed flows were distributed based on their frequency of occurrence to establish a flow regime for the watershed, and 10 distinct flow ranges were established. The TSS target and observed flows were then used to calculate loading capacities for each flow range. To identify the load reductions needed to meet the loading capacities, it was necessary to determine the existing TSS loadings in Lake Creek. Because instream TSS data are limited and turbidity data have been available almost daily since 1996 and for a wider range of flows, turbidity data were used along with flow as the basis for identifying the existing sediment loadings. For each of the 10 flow ranges, a representative existing turbidity concentration was identified. These turbidity concentrations were then converted to TSS concentrations based on a correlation equation determined by using observed monitoring data. The TSS concentrations for each flow percentile range were then used to establish existing TSS loadings for the Lake Creek watershed.

The following sections provide more detailed explanations of the methods and process used to calculate the existing loadings and the loading capacity for Lake Creek.

5.2. Evaluation of Existing Loads

It is necessary to determine the existing conditions in Lake Creek to evaluate the load reductions needed to meet TMDL allocations. The existing TSS loads in Lake Creek were calculated by establishing a load duration curve based on observed turbidity and flow data. Because TSS data are not available over a long period of time or for a wide range of flows, turbidity data were used to evaluate existing loads, which were then converted to TSS loads based on the TSS-turbidity correlation established from observed data. The calculation of the existing loads relies on identifying a turbidity level for each of the flow ranges that represents existing conditions. Therefore, the existing loading analysis is highly dependent on the underlying data used. The following sections discuss the data used for identifying existing turbidity conditions, and therefore the existing TSS loadings, and the method applied to calculate the loadings.

Data Used in the Analysis

All the data available for the Lake Creek watershed were evaluated for their appropriateness for use in this TMDL analysis, specifically for the identification of a TSS-turbidity relationship and the subsequent evaluation of existing loadings. The entire record of turbidity data was evaluated to identify the appropriate data and associated period of record to use in the analysis of loads in Lake Creek.

To evaluate the loading conditions within the Lake Creek watershed, it is important to have data that appropriately reflect the range of water quality and flow conditions that occur in the creek. Turbidity and flow data were evaluated for the entire period of record to evaluate any identifiable water quality trends. Evaluation of the data indicated an obvious increase in turbidity values in October 1997 at the Godde station (Figure 5-1). Corresponding turbidity and flow values were evaluated to investigate potential explanations for this variation in the data. A least-squares test was conducted to identify a running correlation of turbidity and flow. As shown in Figure 5-2, turbidity and flow follow a similar (and expected) pattern of turbidity increasing with flow throughout the majority of the period of record.

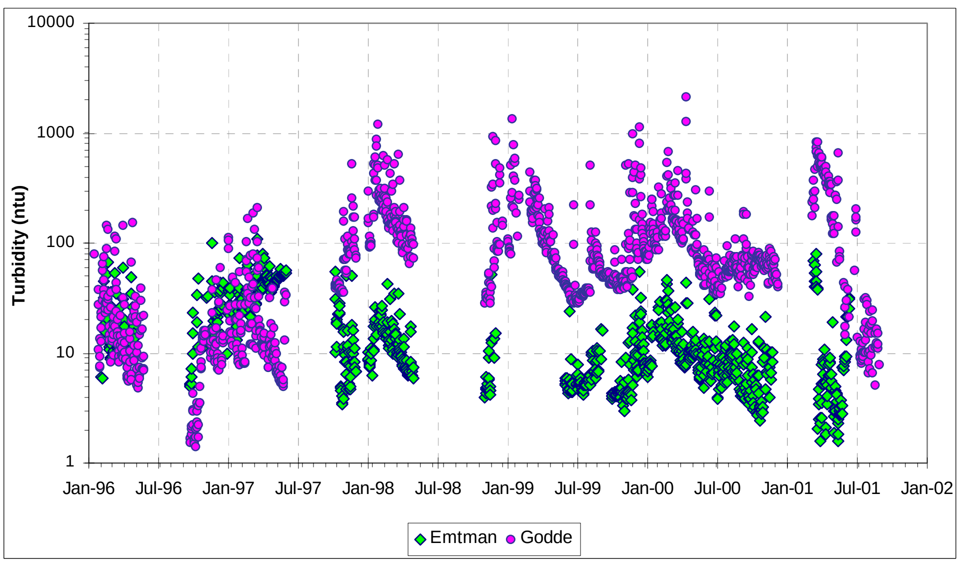


Figure 5-1. Daily average turbidity at the Emtman (upstream) and Godde (downstream) stations.

However, data collected after October 1997 show an increase in turbidity readings with flow remaining comparable to pre-October values. This shift in data is represented in the least-squares test with a reverse in the flow-turbidity pattern beginning around February 1997, with turbidity decreasing as flow increases. The pattern then returns to one where turbidity increases with increasing flows and decreases with decreasing flows. However, the turbidity values are significantly higher than the previous measurements. Discussions with the Lake Creek TMDL Advisory Committee indicated that a major rain-on-snow event in the watershed produced flood conditions in early 1997. Logging at a parcel of forest property near the Godde station also occurred during the spring of 1997, likely increasing sediment runoff to the stream. The anomalies in the flow-turbidity relationship could be attributed to extreme flow conditions and the subsequent, temporary alteration of the environment due to the rain-on-snow events, as well as increased sediment runoff and delivery due to the isolated logging activities.

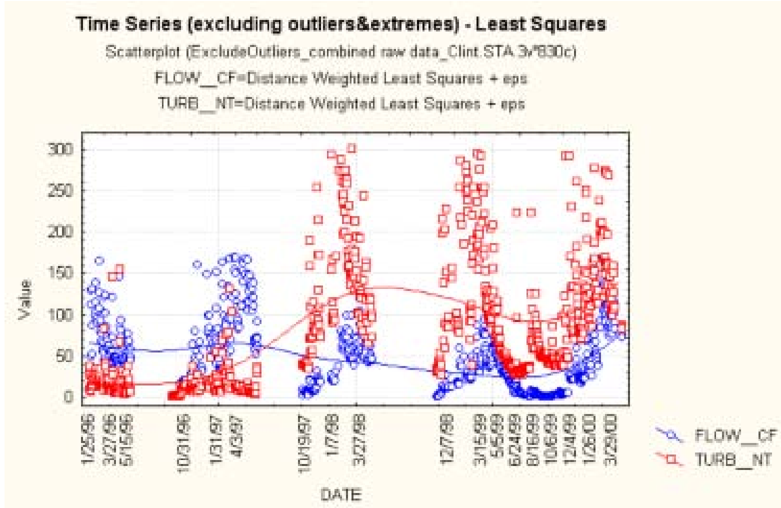


Figure 5-2. Correlation of flow and turbidity in Lake Creek.

The monitoring equipment at the Godde station is located in a portion of the stream close to the culvert discharging the muddy runoff from the logging site. When the logging runoff enters the stream, it mixes with and likely becomes diluted by the stream flow with lower sediment concentrations. However, because of its location, the equipment was likely capturing unmixed conditions in the stream and was measuring concentrations dominated by the logging discharge and its elevated sediment concentrations. Because the data measured during these conditions are not considered representative of the actual stream conditions at the Godde site, data from October 1997 through June 2001 were excluded from the estimation of existing loading in the Lake Creek TMDL analysis.

Calculation of Existing Loads

To calculate the existing loadings, a representative existing turbidity concentration was needed for each of the flow ranges. Although the maximum stream loading would be obtained by using the maximum turbidity observations, these maximum concentrations are attributed to extreme events and are not expected in an average year; therefore, the 70th percentile turbidity reading for each flow range was used to establish the existing conditions. For calculating the existing TSS loadings, the 70th percentile turbidity concentrations were converted to an "existing" TSS concentration (Table 5-1) based on the relationship established between observed turbidity and TSS (Section 3.2). Figure 5-3 presents the observed average daily turbidity readings distributed by associated flow percentiles, with the 70th percentile levels representing existing conditions. Figure 5-4 presents the converted TSS concentrations based on observed turbidity and "existing" turbidity values.

Table 5-1. "Existing" Turbidity Values and Corresponding TSS Values

Flow Range	70th Percentile Turbidity (NTU)	Existing TSS (mg/L)
0–10%	12.8	22.7
10–20%	16	28.5
20–30%	9.8	17.3
30–40%	15	26.7
40–50%	20.4	36.6
50–60%	28.8	52.0
60–70%	24.4	43.8
70–80%	28.6	51.6
80–90%	47.7	86.4
90–100%	76.2	138.3

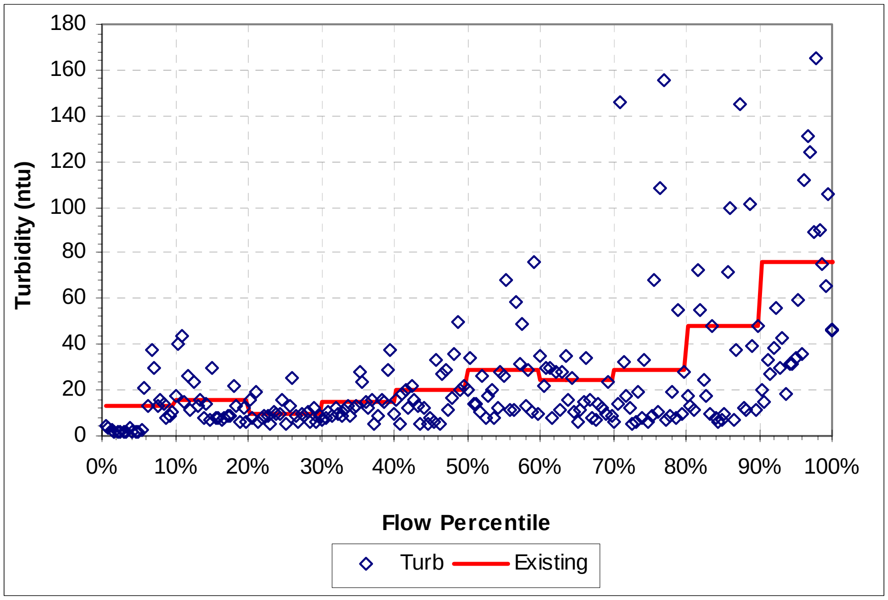


Figure 5-3. Observed average daily turbidity and representative "existing" levels.

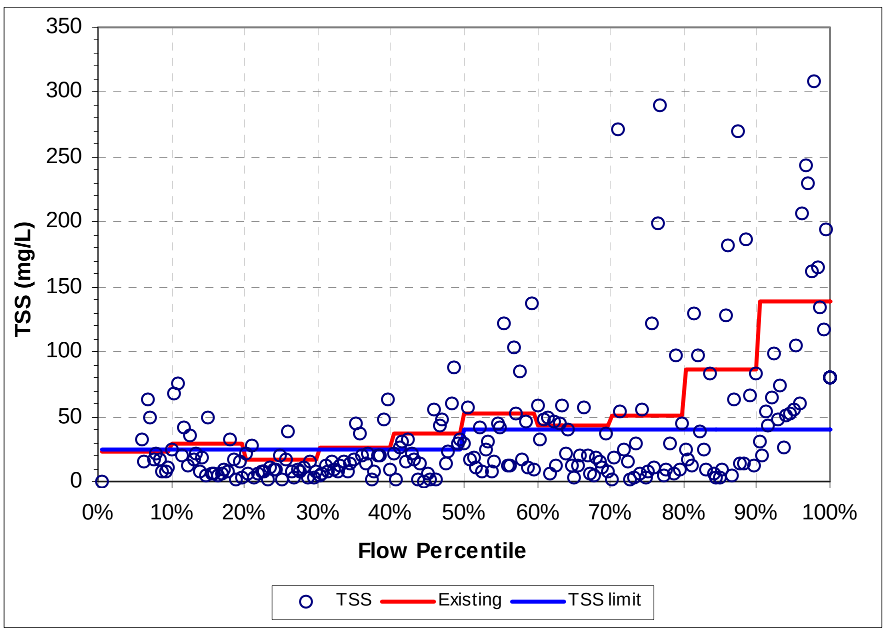


Figure 5-4. Converted TSS values and representative "existing" levels.

A load was calculated at each flow percentile using the flow and the existing TSS for the flow range. This resulted in 100 TSS discrete loads that were plotted as a function of the cumulative flow distribution (Figure 5-5). The area under the load duration curve represents the total average annual loading.

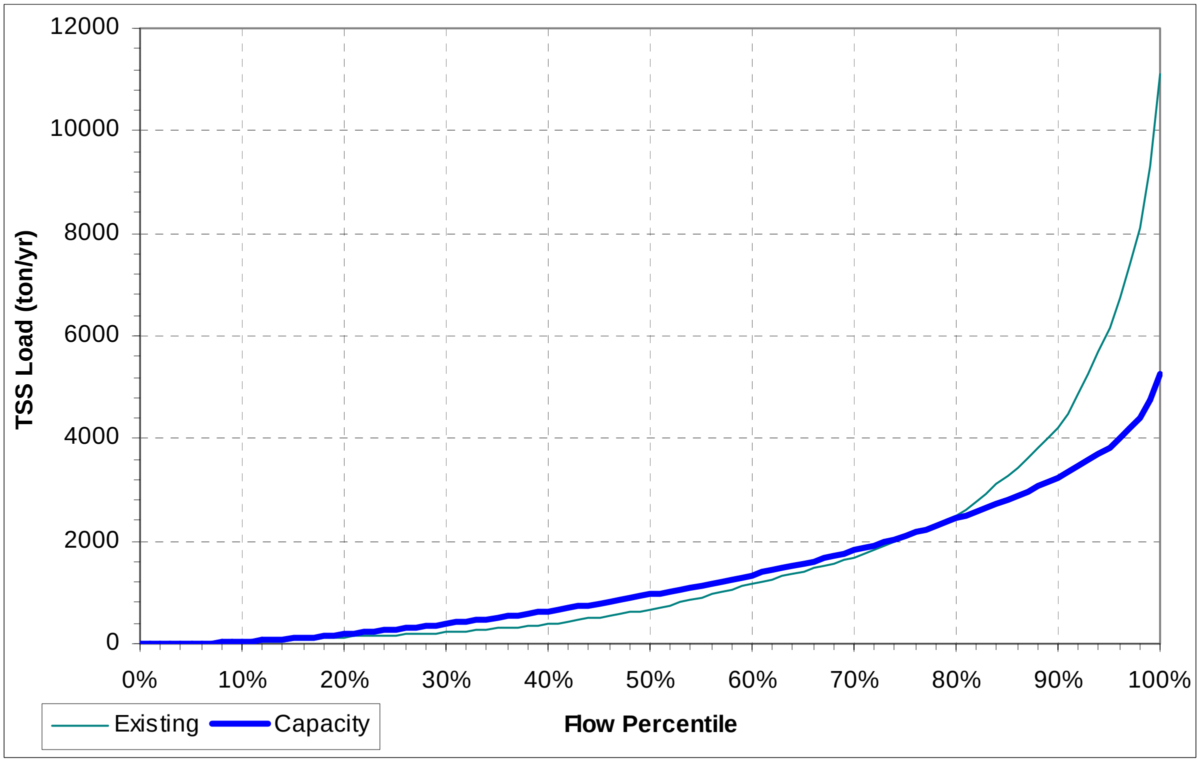


Figure 5-5. Loading capacity and existing loading curves for Lake Creek (at Godde).

The trapezoidal method was used to determine the area under the curve, representing the existing TSS load for Lake Creek. The flow and existing load were calculated at 1-percentile flow increments. The area of an incremental trapezoid is equal to the width (1 percentile) multiplied by the height (average loading). Therefore, the area for each incremental trapezoid was calculated as the average of the loading rate at the previous and current percentiles. For example, the existing loading for the 49th to 50th incremental percentile was the average of the 49th percentile existing load and the 50th percentile existing load. The 100 individual incremental loads were summed and divided by 100 percentile increments to get a total load in tons/year.

Because the TMDL is representative of the entire Lake Creek watershed, the flow rates were adjusted to reflect the additional drainage area between the Godde monitoring station and the mouth of Lake Creek at Windy Bay. Approximately 14 percent of the watershed area lies downstream of the Godde station. Therefore, the flows (and loading) were increased by 14 percent. Table 5-2 summarizes the existing load calculation for the entire Lake Creek watershed.

Table 5-2. Existing TSS Loads in Lake Creek

Flow Percentile	Flow (cfs)	Existing Load[1] (tons/yr)	Cumulative Existing Load[2] (tons/yr)
10	28.6	22.8	22.9
20	44.7	103.2	126.0
30	55.5	94.4	220.4
40	73.9	164.3	384.7
50	89.1	288.2	673.0
60	107.4	493.3	1166.3
70	135.3	523.2	1689.5
80	178.4	799.1	2488.6
90	239.5	1729.2	4217.8
100	1404.9	6881.6	11099.4

[1] Represents loads for the flow range (e.g., 30th–40th percentile range).
[2] Represents cumulative loads through the maximum percentile of the range (e.g., 0–40th).

5.3. Evaluation of Loading Capacity

One of the essential components of a TMDL is identifying and representing the relationship between the desired condition of the stream (expressed as the water quality target) and pollutant loadings. Once this relationship has been established, it is possible to determine the capacity of the waterbody to assimilate sediment loadings and still maintain acceptable sediment levels or aquatic habitat. Although the Beneficial Use Reconnaissance Project demonstrates habitat impairment, it is difficult to quantitatively link habitat measures to sediment loading. But it is assumed that reductions in sediment loading will ultimately result in improvements of habitat quality. For example, decreases in sediment loading will decrease the chances for sediment deposition in spawning habitat and will decrease water column sediment that can disturb fish visibility. Therefore, the TMDL is based on a numeric instream TSS limits and will incorporate future habitat monitoring to assess improvements in habitat quality.

The loading capacity for Lake Creek was calculated using the same load duration method as the existing loading. However, because the loading capacity corresponds to desired conditions, calculation of the loads used observed flows and the TMDL TSS target as the instream concentration. To determine the overall loading capacity of Lake Creek, the TSS limits of 25 and 40 mg/L was multiplied by the observed flows at the Godde station to determine individual sediment loading capacities for each flow percentile. The 100 individual capacities were plotted to establish a loading capacity curve, as shown in Figure 5-5 with the existing loading curve for Lake Creek. The representative total load corresponding to each of the 10 flow percentile ranges was calculated and is presented in Table 5-3.

Table 5-3. Summary of Existing Loads and Loading Capacities for TSS by Flow Range

Flow Percentile	TSS Target mg/L	Flow (cfs)	Existing Load[1] (tons/yr)	Capacity[1] (tons/yr)	Cumulative Existing Load[2] (tons/yr)	Cumulative Capacity[2] (tons/yr)
10	25	28.6	22.8	25.1	22.9	25.2
20	25	44.7	103.2	91.0	126.0	116.3
30	25	55.5	94.4	125.8	220.4	242.1
40	25	73.9	164.3	156.1	384.7	398.2
50	40	89.1	288.2	199.4	673.0	597.6
60	40	107.4	493.3	378.7	1166.3	976.3
70	40	135.3	523.2	473.0	1689.5	1449.3
80	40	178.4	799.1	624.0	2488.6	2073.3
90	40	239.5	1729.2	814.6	4217.8	2887.9
100	40	1404.9	6881.6	2006.2	11099.4	4894.1

[1] Represents loads for the flow range (e.g., 30th–40th percentile range).
[2] Represents cumulative loads through the maximum percentile of the range (e.g., 0–40th).

6. TMDL

A TMDL is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation

$$\text{TMDL} = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + \text{MOS}$$

One of the essential components of a TMDL is identifying and representing the relationship between the desired condition of the waterbody and pollutant loadings. Once this relationship has been established, it is possible to determine the capacity of the waterbody to assimilate loadings and still maintain designated uses. Identifying a limit for TSS and then determining the average annual loading of sediment in tons/year for both point and nonpoint sources, which would result in meeting the TSS limits, have determined the loading capacity of Lake Creek.

For some pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds or kilograms per day). In some cases a TMDL is expressed as another appropriate measure that is the relevant expression for the reduction of loadings of the specific pollutant needed to meet water quality standards or goals. The TMDLs for sediment for Lake Creek are expressed in terms of TSS loading (tons/year). Table 6-1 presents a summary of the TMDL for sediments in Lake Creek, and the following sections provide more details on the individual elements of the TMDL.

Table 6-1. Sediment TMDL for Lake Creek

Source	Annual Existing TSS Load	Estimated Percent Reduction	Annual Allocated TSS Load
Nonpoint Sources:			
Lake Creek watershed	11,099.4 tons/yr	56%[3]	4878.0 tons/yr
Point Sources:			
Idaho Transportation Department	N/A tons/yr[1]	N/A%[1]	16.1 tons/yr
Total Existing Load	**11,099.4 tons/yr**	**Load Allocation**	**4,878.0 tons/yr**
Total Annual Load Reduction = 56%		**Wasteload Allocation**	**16.1 tons/yr**
		Margin of Safety[2]	**0 tons/yr**
		TMDL = Loading Capacity =	**4,894.1 tons/yr**

[1]There is an existing load due to construction starting in April of 2004 that cannot be measured.
[2]MOS was included implicitly through conservative assumptions.
[3]11,099.4 tons/yr – 4,894.1 tons/yr = 6,205.3 ton/yr reduction or 6,205.3 ton/yr /11,099.4 ton/yr = 56% reduction

6.1. Wasteload Allocation

The only permitted point source in the watershed is the Idaho Transportation Department. They have a general construction NPDES permit during the realignment of Highway 95 for a period of three years with EPA. NPDES permits outline when and what a point source can discharge into a receiving waterbody.

Additionally this TMDL establishes a wasteload allocation of 16.1 tons/year to ITD based on application of appropriate Best Management practices (BMPs) and other measures during construction and post construction as described below. See Appendix B as to how the wasteload allocation of 16.1 tons/year was calculated.

ITD's compliance with this allocation will be measured through: 1) ITD's development of an adequate Storm Water Pollution Prevention Plan (SWPPP) designed to control erosion, sedimentation and onsite material management in keeping with the provisions outlined in this TMDL; 2) ITD obtaining authorization to discharge storm runoff under the NPDES General Permit for Stormwater Discharges from Construction Activities in Idaho, Permit No. IDR10-0000 (also known as the Construction General Permit of CGP), prior to the commencement of construction activities for the US 95 HWY project; 3) compliance with all provisions of the CGP through the duration of the project (use of appropriate BMPs, etd.) and 4) based on monitoring which demonstrates that the TMDL TSS limits of 25 and 40 mg/L are being achieved immediately downstream of the project in the mainstem of Lake Creek. The 50^{th} percentile flow that governs the applicable limit at the U.S. 95 construction project is 65 cfs (i.e., 27% lower than at the mouth based on relative drainage areas). Thus, when stream flow at the U.S. 95 project is less than 65 cfs, the TSS limit will be 25 mg/L, when the flow is greater than or equal to 65 cfs, the TSS limit will be 40 mg/L. In circumstances when TSS levels exceed these limits upstream of the ITD project activities, compliance will be based on a value 10 mg/L higher than the upstream measured value.

During an EPA or CDAT inspection instantaneous readings will be used to distinguish compliance with TMDL limits. If found out of compliance all continuously monitored data prior to the inspection and future data over a 72 hour period will be submitted to EPA and CDAT for review.

If turbidity is being sampled as a means for compliance the turbidity/TSS regression equation of $y=1.8251x-0.6462$ may be used to determine TSS values (figure 3-4).

This TMDL specifies that the ITD SWPPP for the US HWY 95 project must incorporate the following provision, including a monitoring plan, which has been agreed upon by EPA, ITD and the Tribe. In accordance with Parts 1.C.5 and 3.14 of the NPDES Construction General Permit, ITD must incorporate the following control measures into their SWPPP and fully implement them to meet the WLA:

- ITD will institute and adhere to winter project shutdown from October 16 through April 14, during which time there will be no earthwork on the project except that required as part of routine BMP maintenance or installation, or any work required to be done during this period because of regulatory agency requirements, or as needed to remedy unforeseen situations that could otherwise lead to exceedances of the above TSS criteria.

- During winter shutdown, all exposed soil will be maintained in a stabilized condition, except that any areas that must disturbed in accordance with the above allowances will be completely stabilized at the end of every work day.

- ITD and its contractors adhere to the "rule of fives" outlined in ITD guidance materials and other BMP requirements.

    - All disturbed soil surfaces will be stabilized within five days by applying seeding, fertilizer, tackifier, mulch, erosion control blankets, plastic and or other means.
    - No more than five hectares of exposed surface area (disturbed erodible material) will be allowed at any one time.
    - All slopes shall be treated either with temporary or permanent erosion control measures after no more than five vertical meters of construction, regardless of slope angle.
    - No clearing of grubbing will take place outside the physical clearance limits shown on the site plans, and none will take place outside the terms of the schedule specified in the SWPP.

The above measures are crucial to the protection of critical rearing habitat for cutthroat trout in Lake Creek. See Appendix D for more information concerning TMDL regulations with EPA.

6.2. Load Allocation

The loading capacity is equal to the sum of the WLAs and the sum of the load allocations calculated using observed monitoring data and represents the allowable load from watershed sources. The total load allocation is 4,878.0 tons/year and represents a gross allocation to the entire watershed. Table 6-2 presents the individual load allocations corresponding to each evaluated flow range.

Allocations by flow range were established to identify times of greatest loading and focus control efforts; however, because the loads are based on observed instream data, they represent an instream load from the entire watershed and do not provide information on specific sources in the watershed and their contribution to the sediment impairment in Lake Creek. Further evaluation of specific watershed sources (e.g., cropland runoff) and appropriate controls will be performed during development of the TMDL implementation plan.

6.3. Margin of Safety

The MOS accounts for any uncertainty concerning the relationship between pollutant loading and water quality. The MOS can be implicit (e.g., incorporated into the TMDL analysis through conservative assumptions) or explicit (e.g., expressed in the TMDL as a portion of the loadings) or a combination of both.

The MOS was included in the Lake Creek TMDL implicitly through a series of conservative assumptions related to both the estimation of the existing loading and the establishment of the water quality target for the TMDL. The conservative assumptions include the following:

- The available flow record was assumed to be representative of a normal, long-term distribution. However, for several years turbidity was not measured in Lake Creek during the summer months. Therefore, because the analysis required paired turbidity and flow data points, the summer flows during those years were not included in the analysis. Because summer flows tend to be lower than those in the late winter and spring, the flow percentiles are biased toward higher flow rates, resulting in higher estimated loadings.

- The TSS limits were established at 25 mg/L for flows below 89cfs and 40 mg/L for flows greater than 90cfs averaged over a 72 hour period at the mouth. These limits were chosen from a range of recommended values (25 to 80 mg/L) representing maintenance of good fisheries. Because the recommended values represent typical concentrations that allow for some occasional elevated concentrations, the varied application of 25 and 40 mg/L as the limits is conservative.

- The 70th percentile of the TSS readings was assumed as the existing condition. Although not the maximum possible TSS loading, using the 70th percentile TSS concentrations to determine loading results in a higher than average existing loading. This results in larger associated load reductions, providing a margin of safety.

6.4. Seasonal Variation

Instream sediment concentrations are often correlated with the flow conditions in a stream. For example, during times of higher flows due to spring runoff events, instream TSS concentrations are likely to be elevated compared to times of lower flows. Although this TMDL does not specifically establish seasonal TSS load allocations, it is based on a representative flow regime in the Lake Creek watershed. By using flow-based loadings of 25 mg/L when flows are <89cfs and 40 mg/L when flows are >90cfs at the mouth, the TMDL inherently accounts for seasonal variation due to the seasonal influences on weather and, therefore, flow. ITDs WLA is based on the above flows but has been reduced to the following amounts based on the project location (upstream) in the watershed. When stream flow at the U.S. 95 project is less than 65 cfs, the TSS limit will be 25 mg/L when the flows are greater than or equal to 65 cfs, the TSS limit will be 40 mg/L. In circumstances when TSS levels exceed these limits upstream of the ITD project activities, compliance will be based on a value 10 mg/L higher that the upstream measured value.

Table 6-2. Summary of Lake Creek TMDL TSS Load Allocations and Associated Load Reductions

Flow Percentile	Flow (cfs)	Load[1] (tons/yr)	Capacity[1] (tons/yr)	Percent Reduction[1]	Cumulative Load[2] (tons/yr)	Cumulative Capacity[2] (tons/yr)	Percent Reduction[2]
10%	28.6	22.8	25.1	-	22.9	25.2	0%
20%	44.7	103.2	91.0	12%	126.0	116.3	8%
30%	55.5	94.4	125.8	-	220.4	242.1	0%
40%	73.9	164.3	156.1	5%	384.7	398.2	0%
50%	89.1	288.2	199.4	31%	673.0	597.6	11%
60%	107.4	493.3	378.7	23%	1166.3	976.3	16%
70%	135.3	523.2	473.0	10%	1689.5	1449.3	14%
80%	178.4	799.1	624.0	22%	2488.6	2073.3	17%
90%	239.5	1729.2	814.6	53%	4217.8	2887.9	32%
100%	1404.9	6881.6	2006.2	71%	11099.4	4894.1	56%

[1] Represents loads for the flow range (e.g., 30th–40th percentile range).
[2] Represents cumulative loads through the maximum percentile of the range (e.g., 0–40th).

6.5. Reasonable Assurance

In watersheds that have both point and nonpoint sources where pollution reduction goals can only be achieved by including reductions to nonpoint sources. EPA, requires reasonable assurance that reductions will be met must be incorporated into the TMDL. The Lake Creek TMDL will rely on nonpoint source pollution reduction to meet the designated beneficial uses as the point source has negligible input. There is reasonable assurance that implementation, as the next step of the water body management process, will occur. The Coeur d'Alene Tribe has committed itself to having implementation plans developed within 1 year of approval of the TMDL document. The CDAT, the Watershed Advisory Group and local agencies will develop implementation plans, and the CDAT will incorporate them into the implementation plan. Also, in measuring the effectiveness of an implementation activity, CDAT will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained, then further implementation will be necessary and further reassessment performed until full support status is reached. If full support status is reached, then the requirements of the TMDL will be considered completed.

NPDES Permit Program:

The National Pollution Discharge Elimination System (NPDES) permit is also a Federal permit, which is required under the Clean Water act for the discharge of waste into waters of the United States. EPA has been delegated authority to issue NPDES permits in behalf of the Tribe and the State of Idaho. The NPDES permit is designed to protect the quality and beneficial uses of surface water resources from pollution in storm water runoff from construction activities. To achieve this goal, the permit requires operators to plan and implement appropriate pollution prevention and control practices for storm water runoff during the construction period. These Best Management Practices (BMPs) are aimed primarily at controlling erosion and sediment transport, but also include controls, including good housekeeping practices, aimed at other pollutants such as construction chemicals and solid waste (e.g., litter). As used in this permit, the terms "Construction and Construction-related activities" include all clearing, grading, excavation, and stockpiling activities that will result in the disturbance of one or more acres of land area (EPA Website NPDES Permits)

This permit assures that the water quality limits outlined in the TMDL will be met as it will be incorporated into the contractor's SWPPP, QATSP and their NPDES permit.

Point Sources:

EPA will hold point sources in compliance to their wasteload allocations through the issuance or revision of NPDES permits. Idaho Transportation Department (ITD) is the only point source in the Lake Creek watershed. They have received a load allocation of 16.1 tons/year while they re-align HWY 95. Currently ITD has a general construction NPDES permit. Their NPDES permit will incorporate the load allocation along with meeting instream TSS limits of 25 mg/L for flows below 65cfs and 40 mg/L above 66cfs. Their NPDES permit will also include the BMPs outlined in section 6.2 of the TMDL and the wording in section 6.2 will be incorporated into their SWPPP and QATSP plan. The Coeur d'Alene Tribe, Water Resource Program and ITD wrote a monitoring plan to insure that the instream limits for TSS are being met (see Appendix C).

Non-Point Sources:
Forestry

All Tribal lands that are in tribal ownership and require forestry management will be managed by the Coeur d'Alene Tribe Forestry Department. The Tribal Forest Management Plan (FMP) was recently updated in 2002 and outlines how timber will be managed in TMDL watersheds. The Coeur d'Alene Tribe Forestry Department is in charge of monitoring, and enforcing the BMPs that are outlined in the FMP. The majority of funding will come from the Bureau of Indian Affairs.

The FMP outlines BMPs for Trust Forest within the Coeur d'Alene reservation dealing with timber harvest, road construction, reconstruction and maintenance, residual stocking and reforestation, the use of chemicals and petroleum products, slash management and prescribed fire. They are in charge of the management of forest roads on Tribal land, issuing harvesting permits along with continued forest inventorying.

The FMP also includes Recommendations for Riparian Buffer Strips that were developed by the Tribes Fish, Water and Wildlife Programs and approved by Tribal Council in 2001. Forestland management with regard to the riparian management zone (RMZ) focuses on four major areas of issues and opportunities 1) minimizing the potential for cumulative effects; 2) maintaining potential inputs of woody debris; 3) maintaining continuous riparian corridors, with structurally complex plan communities; and 4) rehabilitating degraded riparian resources within individual watersheds to the maximum extent.

Class I Streams – Recommended widths of RMZ along Class I Streams range from 100-200 feet horizontally on both sides of the active channel.

Class II Streams – RMZ on Class II streams will vary depending on the soil stability rating for adjacent hillslopes. Those streams with stable ratings will have a RMZ ranging from 30-70 feet. Those streams with moderate or unstable ratings will have a RMZ ranging from 50-100 feet.

Class III Streams/Drainages – Along forested streams with stable and moderately stable hillslopes, a RMZ ranging from 25-50 feet wide extending horizontally on both sides of the channel. Along streams with unstable hillslopes, RMZ range from 25-75 feet wide.

Agriculture

The Coeur d'Alene Tribe Land Services Program develops Conservation Plans for farmers that farm trust land within the Reservation. The Lease Compliance Specialist is in charge of enforcement of the Conservation Plans. Farmers not farming trust land that comply with the federal farm programs are required to follow a conservation plan prepared by the Natural Resource Conservation Service (NRCS).

Farmers that have a conservation plan through the Coeur d'Alene Tribe, Land Services Program must agree to the following.

1) The Coeur d'Alene Tribe, Land Services, is authorized and empowered to make modifications to the Soil Conservation Program to cope with changing or emergency situations.
2) Highly erodible cropland
    a. All farming on highly erodible cropland shall be conducted in accordance with recognized principles of good cultural practices and prudent management. Damages for non-compliance = lease cancellation.
    b. If the tenant is participating in the USDA Farm Programs, you must maintain the following crop residue levels: Fall Planted conditions, following low residue producing crops, such as lentils, the producer will use an approved tillage system or meet crop residue levels of 400 pounds per acre, or 23% cover after peas; and 300 pounds per acre, or 18% cover following lentils. Producers using an approved tillage system will be considered as meeting the required residue levels. The following approved Alternative Tillage Systems may be used in place of residue management practices following low residue producing pea and lentil crops:
        i. No-Till Planting Systems
        ii. Shank fertilizer, spray for weeds and plant systems
        iii. Shank fertilizer, rodweed one time and plant systems
        iv. Cultivate on time, shank fertilizer, rodweed one time and plant systems
        v. Chisel, shank fertilizer, rodweed one time and plant systems

        Fields planted using any of the above systems will use the least number of tillage operations possible, and use implement settings that bury the least amount of residue.

        Disks or inversion plows will not be used following peas or lentils.

    Fall planted conditions following moderate residue producing crops such as black peas, and yellow peas, or other conditions where it is not feasible due to residue being too heavy to use the approved minimum tillage system, producers will be required to have 30% cover of 550 pounds of residue per acre following planting of fall crops. Fall planting conditions following high residue crops, such as recrop after cereal grains, rape, canola, barley, oats, etc., producers will have at least 550 pounds of residue per acre or 30% cover.

    Summer Fallow, (if authorized by landowners), will have a minimum of 550 pounds of residue or 30% cover after planting. Stubble will be left standing over winter following harvest or use non-inversion tillage if acreage is to be summer fallowed the following year. Following high residue producing crops, producers are required to have 1000 pounds per acre of residue of 50% cover on acreage unplanted that is going into the fall critical erosion period. Minimum residue levels will not be required during the first critical erosion period following sod breakout. Minimum residue levels will not be required following spring planted crops. Damages for non-compliance = reduction or elimination of all USDA Program Benefits (FSA&NRCS).
3) Wetland
    a. No conversion of wetland is authorized. If the acreage in question is prior converted wetland, the area may be farmed but no additional conversion would be allowed (e.g., tiling).

4) Tillage operations
    a. Tenant agrees to perform all tillage and seeding operations across slope as close to the contour as possible. Tillage and seeding operations will be performed parallel to terraces or diversions where such structures exist. All plowing will be performed from the center of the field out. If any roadside ditches are filled due to the tillage operations in use, the tenant will be required to pay for all ditch repair.
5) Burning of crop residue
    a. Burning of crop residue on any cropland, or pasture land requires authorization (permit) from the Coeur d'Alene Tribe, Land Services, if the burning takes place from August 1 through September 30. Burning for weed or erosion control purposes along stream banks, channels and waterways (1 acre or less) does not require a permit. Damages for non-compliance will be $25.00 per acre.
6) Weed Control
    a. Tenant will eradicate or control all noxious weeds in accordance with the noxious weed laws of the State of Idaho, County Weed control districts and in a manner satisfactory to the Government. Damages for non-compliance will be $25.00 per acre.
7) Pesticides
    a. Any and all pesticide usage by the Tenant shall be in accordance with all applicable State and Federal regulations. The Tenant shall indemnify the Landlords against any crop loss based on the Tenants failure to comply with this stipulation.
8) Conservation Structures
    a. Tenant agrees to maintain all waterways and diversion terraces, dams and other conservation structures as shown on the Conservation Plan Map in permanent vegetation. Machinery crossings (across ditches and streams) shall be rocked and maintained. Damages for non-compliance shall be the cost of remedial/corrective measures for correction of the mismanagement as determined by the Coeur d'Alene Tribe, Land Services.
9) Crop Rotations
    a. Maximum acreage of income producing crops shall be grown each year, consistent with restrictions of USDA Farm Programs (if applicable). The tenant must have prior written permission of at least 50% of the ownership (unless the lease is cash or cash guarantee) to summer fallow an acreage.
10) USDA-FSA Wheat & Feed Grain Program Participation
    a. The tenant can stay out of the Wheat & Feed Grain Program, without consent of the owners, if participation is optional. At this point in time, the Wheat & Feed Grain Program administered through FSA is optional. If the tenant chooses not to participate in the Wheat & Feed program, the tenant still must file a crop report with the appropriate FSA Office where the land is located. This action will ensure that the Wheat &/or Feed Grain Bases are protected to the extent the law allows.
11) Reports
    a. Crop and/or Pasture use reports shall be filed with the Coeur d'Alene Tribe, Land Services on authorized forms immediately after harvest but not later than December 31st of each year. Damages for non-compliance will be $1.00 per day per delinquent report.
12) Property Access
    a. Tenant agrees to allow the Coeur d'Alene Tribe, Land Services, free access to all lands covered by this CPO for the duration of the lease.

Water Quality

The Coeur d'Alene Tribe Water Resource Program enforces the tribally adopted water quality standards. All TMDL listed segments will met the tribally adopted water quality standards or the most downstream water quality standards. All streams that discharge into Coeur d'Alene Lake will met the limits established in the Coeur d'Alene Lake Management Plan (Clean Lakes Coordinating Council et. al, 1996).

Implementation will consist of implementing best management practices that reduce sediment input, stream bank erosion and decrease stream temperature. Section 7 of the TMDL outlines past projects along with BMP's for future implementation.

Monitoring on reservation streams will occur to ensure that nonpoint source reduction mechanisms are operating effectively and the reduction efficiency of the BMP's that are in place. The Tribe will use the research monitoring and evaluation plan (RM&E) written by the Coeur d'Alene Tribe Fisheries Program (Vitale, et. al, 2002) as guidance until a non-point source pollution plan is completed. The RM&E plan outlines the monitoring and evaluation strategy for measuring the effectiveness of restoration work on the Coeur d'Alene Reservation and to track trend in fish populations. See section 8 of the TMDL for a complete outline of the Tribes monitoring protocol for Lake Creek.

7. Implementation

Although not legally required, an implementation plan is crucial to the success of a TMDL. An implementation plan for the Lake Creek TMDL will likely be developed by the CDAT and other local agencies and will evolve as the TMDL is finalized. This section identifies expected goals, control options, and timelines to be included in the implementation plan.

The wasteload allocation of 16.1 tons/yr for ITD will be included in their NPDES permit, SWPPP & QATSP along with the flow based limits of 25mg/L when flows are <65 cfs and 40 mg/L when flows are <66 cfs. If the limits are exceeded at the upper sampling station then the upper gauge reading may be exceeded by 10 mg/L.

ITD's SWPPP contains a complete list of proposed BMPs along with a description that ITD plans to use during construction. Interim stabilization shall consist of BMPs including, but not limited to the following: silt fencing, temporary mulch, stone filter dams, earth berms, temporary pipes, temporary stream crossings and soil stabilizers. Permanent stabilization shall include the following items: seeding, mulching, and tackifier, conventional straw or wood fiber mulch, bonded fiber matrix mulch, rock lined ditches, riprap culvert inlet and outlet protection, rock armor and erosion control geotextile.

The contractor is responsible for inspection and maintenance logs of erosion and sediment BMPs, structures and maintenance. Inspections will be performed in accordance with part VIII Inspections of the permit. If existing BMPs need to be modified or if additional BMPs are necessary for any reason, implementation will be completed before the next storm event when ever practicable. Sediment traps or sedimentation ponds will be cleaned once design capacity has been reduced by 50 %.

7.1. Implementation Focus and Target Reductions

Because it is difficult to directly link habitat quality to sediment loading, the Lake Creek TMDL is based on an instream TSS concentration assumed to represent conditions of good fisheries production. However, the implementation plan for restoring designated uses of Lake Creek will not focus simply on reducing TSS but rather on identifying control actions that will effectively and cost-efficiently restore aquatic habitat, reduce sediment loading and its detrimental effects, and ultimately result in improved water quality and designated use support. The CDAT, Idaho DEQ, and other responsible agencies will attempt to link watershed characteristics to past, present, and future pollution problems to identify and implement management practices that will most efficiently improve water quality and restore designated uses.

The Lake Creek TMDL establishes allocations by flow range to identify times of greatest loading and focus control efforts; however, because the loads are based on observed instream data, they represent an instream load from the entire watershed and do not provide information on specific sources in the watershed and their contribution to the sediment impairment in Lake Creek. Further evaluation of specific watershed sources (e.g., cropland runoff) and appropriate controls will be performed during development of the TMDL implementation plan to focus management efforts on controllable sources that significantly affect instream conditions. The Coeur d'Alene Tribe's watershed assessment (CDAT, 2000) can be used to initially gain some insight into the sources needing control to restore designated uses. CDAT (2000) estimated sediment loads from major sources in the watershed. Table 7-1 uses the source load distribution established in CDAT (2000) to approximate the distribution of existing instream loads in Lake Creek. Table 7-1 also includes target load reductions for the watershed sources to meet the TMDL loading capacity, focusing reductions on more controllable sources.

Table 7-1. Target Load Reductions for Watershed Sediment Sources

Source	Percent of Total Load[1]	Estimated Existing Load (tons/yr)	Targeted Percent Reduction	Target Load (tons/yr)
Soil creep	5.4	595.0	0	262.4
Mass wasting	6.4	704.9	0	310.8
Road system	2.5	282.0	15	124.3
Cropland erosion	80.3	8908.2	69	3927.9
Gully erosion	5.5	609.3	0	268.6
TOTAL		11099.4	56	4894.1

[1] From CDAT (2000).

A stream bank assessment should be performed to identify bank erosion along the creek. A more in depth assessment of the erosion coming from the agricultural fields should be completed to update the one that was completed in 1998. An assessment of forestland and roads should also be completed as forestlands were never assessed in the 2000 lake creek assessment and the roads would most likely need to be updated.

The Coeur d'Alene Tribe has one of the top GIS programs in the northwest. Currently all Tribally completed restoration projects to date have been put into a GIS database that identifies affected area and the potential benefit. All future projects and projects completed by the NRCS and KCSWCD will be added to this database along with the cost of each project.

7.2. Proposed Control Actions

The implementation of the Lake Creek TMDL and associated control activities will be a locally driven effort, depending on the cooperation of the tribe, the state, local agencies, and area property owners. Although this section does not outline specific control efforts and responsibilities, it provides information on the elements and priorities that should be included in the Lake Creek TMDL implementation plan. The implementation plan will also include a detailed monitoring plan.

Reduce Sediment Inputs from Agricultural Sheet and Rill Erosion

Sediment budget analysis indicates that the Lake Creek drainage system is presently aggrading because of fine sediment input which exceeds the annual sediment discharge capacity. Suggested practices to reduce agricultural sediment input include the following:

- Conversion to permanent cover crops such as bluegrass. Measures to protect annual burning, or provide an economically viable alternative, are included as part of the conversion process.

- Establishment of buffer and filter strips along the Lake Creek mainstem, major tributaries, and major ephemeral drainages. Ephemeral drainages carry substantial sediment loads during runoff events, and should be managed similar to permanent reaches of the system. Buffer and filter strips also need to be employed along bluegrass fields, as substantial erosion is observed on the fields prior to the growing season, and within the fire breaks that often border drainages or road ditches which discharge to the drainage system.

- Agricultural BMPs, including strip cropping, no-till, and structural practices (gully plugs, sediment basins, grass waterways).

The Kootenai-Shoshone Soil and Water Conservation District enrolled 55 percent of the Lake Creek agricultural acreage within Idaho under the State Agricultural Water Quality Program (SAWQP) in 1993. This commits watershed producers to a variety of agricultural BMPs, including conversion to bluegrass. As the contracts are completed, the Lake Creek watershed should receive reduced sediment loads from sheet and rill erosion on cropland. In 1999, SAWQP was replaced with the Water Quality Program for Agriculture (WQPA) to provide financial incentives to owners and operators of agricultural lands to apply conservation practices to protect and enhance water quality and fish and wildlife habitat.

The majority of landowners inclined to cooperate with agricultural conservation measures were enrolled under SAWQP. Of approximately 680 acres of tribal allotted land in agriculture in the watershed, 480 acres (71 percent) are treated with a combination of permanent cover crop and structural BMPs. The tribe will continue to implement and evaluate BMPs on tribal land. Sheet and rill erosion reduction efforts by the tribe should be directed to the establishment of buffer and filter strips as described above.

Restore Riparian Zones and Increase Streambank Canopy Cover

Canopy cover along Lake Creek and its tributaries is less than the 75 percent closure recommended for salmonid habitat for most of the drainage system. Canopy restoration is critical to maintaining water temperatures suitable for salmonids. Improving the riparian zone will not only stabilize the banks and decrease streambank erosion it will also decrease instream temperatures due to the increase in canopy cover. Practices should include the following:

- Tree and shrub planting along reaches that presently lack a riparian zone. Species selection should provide various canopy levels and include native species whenever possible. A conifer component is important to provide shade throughout the year and for recruitment of large woody debris. This process is under way, funded by various federal, state, and private grants.

- Enhancement of existing riparian zones. Planting in such areas should provide the missing components. Several reaches between U.S. Hwy 95 and the Lake/Bozard Creek confluence have riparian zones consisting of a single shrub row. Such areas should be planted to provide additional canopy levels and future large woody debris. Reaches below U.S. Hwy 95 would also benefit from supplemental planting, since a near-stream conifer component is presently lacking and large woody debris recruitment is poor.

- Restoration of upland canopy cover wherever possible. Canopy removal and thinning in the uplands has increased flash flooding by increasing snow accumulation and subsequent rain-on-snow events. Canopy losses also destroy cool microclimates typical of well-stocked coniferous forests in stream valleys. These function as cold air drains and remain cool even during hot summer days.

Augment Base Flow of Lake Creek and Tributaries with Storage ponds

Summer low flows contribute to excess stream temperature and reduce available habitat for resident fish and rearing of adfluvial stock. A system of storage ponds for flow augmentation is presently being implemented and should remain a priority. The ponds are off channel, the water will be drawn from the bottom of the ponds and allowed to work its way down to the creek through channels or filter into the ground to recharge the water table. The ponds have additional benefits of trapping suspended sediment and providing wildlife habitat. Two of the storage ponds were monitored during release in 2003. The results of this monitoring concluded that all ponds should have a temperature profile completed prior to release. Water should not be drawn from the four lower ponds that are above 15^{o}C. Lake Creek should be monitored on a continuous basis to determine release times. Further conclusions relate to the volume of water that is released. It appears from the available data that the lower release rate (25 gpm, or that available from the valve installed in the lowest splashboard) can effect a reduction in temperature in Lake Creek. However, it is not currently possible to open these valves without someone entering the primary spillway; this considered to be impractical and a safety hazard due to the confined space. Therefore a long-handled key should be fabricated that can be used to open these valves from the top of the spillway box. It still appears appropriate to attach a pipe to these valves in order to draw the coolest water from the bottom of the ponds. It is therefore recommended that all ponds not currently having valve and pipe systems have those installed (Coeur d'Alene Tribe, 2003).

Mitigate Flow Disturbance and Sedimentation Due to Forest Roads

Forest road surfaces and cut-and-fill slopes are the predominant sediment source from forested highlands. Also, forest road cutslopes convert water in ground storage to surface runoff, which exacerbates flash flooding and summer low flow conditions. Projects to mitigate these effects include the following:

- Road obliteration and revegetation. Roads treated with obliteration should be returned to original grade to restore natural slope hydrology. Older, highly compacted roads could require installation of French drains to draw water into the subsurface. Where return-to-grade projects are cost-prohibitive, road subsoiling and revegetation will restore some infiltration capacity and reduce channelization of sheet flow from hillsides.

- Permanent road closure and natural revegetation where access needs or cost prevents more aggressive treatments.

- Seasonal road closure for roads used for present or anticipated timber harvest. Closure from winter to the cessation of the runoff season will reduce sediment delivery from road surfaces. This will not, however, restore natural slope hydrology, which is necessary for base flow maintenance.

7.3. TMDL Implementation Timeline and Adaptive Management Approach

The implementation plan developed for Lake Creek will more specifically identify implementation activities and schedules. Table 7-2 provides a general recommended timeline for the implementation of the TMDL and associated control activities. The plan will also include a review schedule, recognizing that TMDL implementation may be an iterative process. The plan will include phased implementation of BMPs with monitoring designed to evaluate the BMPs effectiveness and improvement in water quality. Periodic reviews of monitoring results will be used to evaluate progress toward attaining TMDL goals and restoring water quality standards and designated uses. The monitoring results and reviews will provide a feedback loop to evaluate the appropriateness of the TMDL and its implementation plan. If necessary, the TMDL and/or implementation plan will be revised based on new information collected during the follow-up monitoring.

Table 7-2. General TMDL Implementation Plan Time Line

Activity	Lead Agency (Support Agencies)	Completion Date
Completion of *Lake Creek TMDL Implementation Plan*, including specific sediment load reduction practices, party responsible for their implementation, and deadlines for their implementation	CDAT (Idaho DEQ)	1 year from issuance of TMDL
Implementation of Phase I Controls (to be specified in implementation plan)	To be specified in implementation plan	Within 1 to 3 years from TMDL issuance
Implementation of Phase II Controls (to be specified in implementation plan)	To be specified in implementation plan	Within 3 to 5 years from TMDL issuance
Monitoring	CDAT, Idaho DEQ	Ongoing as specified in the monitoring plan
Annual Progress Evaluations to track implementation of control efforts and to review monitoring results and effects on TMDL	USEPA (CDAT, Idaho DEQ)	Yearly from issuing TMDL
TMDL Updates or Revisions based on subsequent monitoring results	USEPA (CDAT, Idaho DEQ)	Within 5 to 7 years from TMDL issuance, as necessary

8. Monitoring

Follow-up monitoring for a TMDL is important in tracking the progress of TMDL implementation and subsequent water quality response, as well as in evaluating any assumptions made during TMDL development. Monitoring results can be used to better characterize unknowns in the TMDL analysis (e.g., background concentrations, seasonal variations) and can provide support for any necessary future TMDL revisions. Most important, monitoring will track the water quality of Lake Creek to evaluate future attainment of TMDL targets and water quality standards. If future monitoring indicates that Lake Creek is supporting designated uses prior to meeting load reductions set in the TMDL, the TMDL will be reevaluated and revised accordingly.

The CDAT seeks to continue its ongoing water quality sampling and monitoring in the Lake Creek watershed, as described in this section. Idaho DEQ will collect additional water quality data during their routine monitoring schedules. The TMDL monitoring plan for Lake Creek will rely on three main elements instream water quality monitoring, measurement of other habitat indicators, and the potential identification and monitoring of a reference site.

Monitoring will occur at the following three sites in the Lake Creek watershed:

Upper Lake Creek:
NW 3 NE 3 Sec. 12 T48N R6W
Downstream of crossing of Lake Creek and Elder Road

Bozard Creek:
NW 3 NE 3 Sec. 12 T48N R6W
Just upstream of the confluence with Lake Creek off of Elder Road

Lower Lake Creek:
NW 3 SE 3 Sec. 21 T48N R5W
Downstream of HWY 95 bridge about 2 mile on Lake Creek

8.1. Instream Water Quality Monitoring

Dissolved oxygen, pH, temperature, conductivity, total dissolved solids (TDS), nutrients, and turbidity will be measured at each site on a regular schedule. In addition, paired TSS and turbidity measurements will be taken during rain-on-snow events.

The sampling schedule is developed to capture water quality conditions during both peak and low-flow conditions. This is justified by the fact that the majority of pollutant loads delivered by streams are delivered by several discrete peak flow events. Summer low-flow conditions deliver very little pollutant load by comparison; temperature and discharge become the parameters of concern during dry months.

Dissolved oxygen, pH, temperature, conductivity, turbidity, and discharge will be sampled at the three sites biweekly from March 1 to October 31, and monthly the rest of the season. The schedule will be flexible and adjusted to incorporate a variety of flow conditions.

The two sites on the mainstem of Lake Creek will also be sampled for TSS and turbidity in conjunction with rain-on-snow events. Based on previous years, at least three such events are expected during the period from November 1 to June 1. Peak event sampling at these sites will include collection of discharge and Hydrolab parameters. This sampling is expected for the frozen solid period of January and February and again in mid-April, as TSS can change considerably with the degree of soil freezing.

Table 8-1 provides a summary of parameters to be measured and their frequency, and the following discussion provides details of the methods that will be used in their measurement.

Table 8-1. Coeur d'Alene Tribe Monitoring Plan

Site	Parameter	Frequency
Upper Lake Creek	Discharge, temperature, turbidity, pH, dissolved oxygen, conductivity (TDS)	Biweekly, March 1 through October 31, and peak flow events
	TSS and turbidity	Rain-on-snow events (three events between November 1 and June 1)
Bozard Creek (major tributary to upper Lake Creek)	Discharge, temperature, turbidity, pH, dissolved oxygen, conductivity (TDS)	Biweekly, March 1 through October 31, and peak flow events
Lower Lake Creek	Discharge, temperature, turbidity, pH, dissolved oxygen, conductivity (TDS)	Biweekly, March 1 through October 31, and peak flow events
	TSS and turbidity	Rain-on-snow events (three events between November 1 and June 1)

Regression analysis of stage and discharge measurements will produce rating curves for discharge monitoring points. Measurements are to be taken at low, medium, and high flows so that a complete curve can be obtained. High-capacity equipment will be used to monitor peak events. Previously, some sites had to be bypassed during peak events because of the hazard of wading during high discharge.

Stage readings will be taken from a fixed staff gauge located in the stream. Discharge measurements will be taken using Instream Flow Incremental Methodology (IFIM). Under this approach, the stream is divided into 20 equal-width cells. Velocity is measured in each cell and multiplied by cell area, and the volumes are summed to obtain the discharge measurement in cubic feet per second. Channel profiles will also be taken to monitor changes in stream morphology at the site.

A Hydrolab (trade name for a multi-parameter water quality testing probe) will be used to determine dissolved oxygen, pH, temperature, and conductivity. Total dissolved solids (TDS) will be calculated from conductivity readings. The unit will be calibrated prior to each use according to manufacturer specifications. A calibration log is maintained to ensure that required calibrations are being completed. In addition, calibration is verified monthly using scientific-grade reference solutions. Instrument drift will be checked at the end of each sampling day, and results will be recorded in the calibration log. Once calibrated, the unit is deployed by placing the underwater probe as close as practical to mid-stream and mid-depth. The transmitter is allowed to stabilize for 1 minute. An instantaneous reading is then taken and recorded in a data logger.

Nutrients, TSS, turbidity, total phosphate, and total kjeldahl nitrogen will be collected using methods described in the *Standard Methods for the Treatment of Water and Wastewater* (APHA, 1992). All analyses of this type will be conducted by an accredited (state- or USEPA-certified) contract laboratory. Nutrients will be analyzed using USEPA method 300.0 ion chromatography. TSS will be analyzed using U.S. Geological Survey (USGS) whole sample methodology. Turbidity will be analyzed using USEPA method 180.1. Total phosphate will be analyzed using USEPA method 200.7, Inductively Coupled Plasma. Total kjeldahl nitrogen will be analyzed using standard method 4500-N_{org}B.

8.2. Other Habitat Indicators

In addition to an instream TSS target concentration, the Lake Creek TMDL implementation plan will establish monitoring targets for aquatic habitat measures. Because it is difficult to link such water column measurements as TSS to aquatic life habitat quality, measures of channel and habitat conditions are more useful in directly gauging the availability and quality of aquatic life habitat and support. These indicators include measurements such as riffle:pool ratios, channel substrate composition, and amount of large woody debris. If evaluation of habitat measures indicates that Lake Creek is supporting designated uses prior to meeting load reductions or TSS targets established in the TMDL, the TMDL will be reevaluated and revised accordingly.

The Lake Creek Watershed Assessment (CDAT, 2000) previously evaluated streambank and habitat measures in the Lake Creek watershed. It is expected that additional monitoring of these measures will be conducted to track the improvement of habitat quality in response to the sediment load reductions implemented by this TMDL. Potential habitat measures to be monitored and proposed targets are included in Tables 8-2 and 8-3. The specific targets associated with each habitat measure are proposed and will be further defined in the Lake Creek TMDL implementation plan.

Table 8-2. Proposed Targets for Habitat Indicators

Indicator	Proposed Target	Source
Percent fines (<4 mm) in channel substrates	No more than 10 percent of particles <4 mm	CDAT (2000) [Hickman and Raleigh (1982)]
Riffle:pool ratio	1:1	CDAT (2000) [Hickman and Raleigh (1982)]
Residual pool depth	1.0 m	Personal communication, CDAT, July 2003
Riffle stability index	RSI<70	IDEQ (2003b) [Kappesser (1993)]; CDAT (2000) [Kappesser (1992)]
Fish counts	Phased targets of juvenile fish/m^2 (See Table 2-2)	Personal communication, CDAT, Department of Natural Resources, October 2003
Cobble embeddedness	Targets are not established at this time but will be considered in future monitoring. If future monitoring provides sufficient information on reference levels, quantitative targets will be established at that time.	
Large woody debris		

Table 8-3. Proposed Targets for the Lake Creek Fishery

Segment[2]	Phased Target (juvenile fish/m^2)				
	1998	2007	2012	2016	Beyond
Lower Lake Creek	0.020	0.023	0.061	0.069	0.224
Upper Lake Creek	0.128	0.128	0.178	0.283	0.393

1 Personal communication, CDAT, Department of Natural Resources, October 2003.
2 Lower Lake Creek extends from the Emtman gauging station to the mouth. Upper Lake Creek extends from the Emtman gauging station to the headwaters.

8.3. Identification of a Reference Site

Another approach to evaluating the health or impairment of a watershed is comparison to a reference site that represents unimpaired conditions (i.e., designated uses are supported). A reference site allows for the identification of parameters and characteristics of desired, unimpaired conditions that can be set as targets for the impaired watershed. The identification of an appropriate reference site is dependent on a thorough evaluation of watershed characteristics of both the impaired and reference watersheds. It is important that the two watersheds be similar in terms of soil type, soil and subsurface characteristics, hydrology, land cover, and climate/weather patterns and events. The reference watershed should be as similar to the impaired watershed as possible; basically, it should represent the impaired watershed prior to disturbance or impairment.

During TMDL development for Lake Creek, no reference sites were identified. Waters in the upper watershed are considered to be of good quality; however, the geology and environment of the upper and lower watershed vary. Therefore, it would be inappropriate to set desired conditions for the lower watershed based on conditions in the upper watershed.

In addition to the collection of chemical, physical, and habitat monitoring, the Lake Creek TMDL follow-up monitoring plan will consider the further investigation of available reference sites for Lake Creek. Evaluation of regional water quality data and watershed coverage's (e.g., soils and land use) can identify potential reference sites for the evaluation of impairment in Lake Creek, or it could indicate that an appropriate reference site does not exist.

If a reference site is identified, monitoring comparable to that of the Lake Creek sites will be conducted to support comparison of the two watersheds and the establishment of desired targets for the Lake Creek watershed. Water quality and habitat data collected at the reference site will aid in the evaluation of natural/background conditions of the Lake Creek watershed and the appropriateness of the TMDL load allocations and reductions.

9. Public Comments

This proposed TMDL was open for public comment from February 26, 2004 to April 5, 2004. Comments were received during this public comment period, as shown. A public meeting was held on March 15, 2004 to give the public another chance to comment on the TMDL. Comments were generated but they all dealt with the implementation plan. EPA published a notification on the public comment period and public meeting in the Coeur d'Alene Press, The Idaho Spokesman Review and Council Fires.

A second public comment period was held from May 20 to June 20, 2005 to allow the public to view the changes made to the TMDL concerning the addition of a waste load allocation to the Idaho Transportation Department. EPA published a notification of the public comment period in the Coeur d'Alene Press and the Idaho Spokesman Review. No written comments were submitted. A public meeting was held on August 29, 2005 and again comments received dealt with the implementation plan.

Responses to Comments
Commenter: Mike Mihelich, Kootenai Environmental Alliance, March 22, 2004

Comment	Response	Associated Change to Report
Sediment Reduction calculations:		
The final TMDL should clarify the calculated to determine the amount and percent of sediment that would be reduced in order to meet the TMDL target.	The percent reduction is calculated as follows: (existing load – loading capacity)/existing load = percentage to b reduced. The amount of sediment to be reduced is calculated as follows: Existing load-loading capacity = load that must be reduced. Any discrepancies in the amount of load subtracted and the exact percent reduction is a function of the automatic calculations in the TMDL loading spreadsheet. The spreadsheet contains automatic formulas that calculate the loads and corresponding percent reductions, using values that are results of other calculations and containing several digits after the decimals. Because Table 6-2 contains "rounded" numbers, the direct calculation of the percent reduction (or the loading capacity) from values in Table 6-2 may vary slightly from the automatically calculated reductions and loads.	Showed calculations for the amount and percent of sediment reduced.
The final TMDL should clarify the issue of the correct amount of sediment reduction that would occur for each of the sources	In Table 7-1, the "Reduced Load" represents the final load resulting from the load reductions; it does not represent the load that will be "removed" from the existing load.	Change column title from "Reduced Load" to "Target Load"
Sediment Loadings:		
Information presented on page 27 and Table 4-2, indicates approximately 10,615 tons/yr of sediment from croplands reach the stream system. It is stated on page 28 that the sediment budget does not provide a link to the	The TMDL does not indicate that there is any flaw with the sediment budget nor does not disagree with the statement that sediment from the watershed is retained in the system. It is explaining that the sediment budget does not	

instream conditions and therefore was not used in the TMDL analysis. In spite of the sediment budget statement on page 28, the sediment yield discussion pages 27 and 28 mentions sediment that does not leave the watershed. It appears that a significant portion of the over 10,000 tons per year of sediment does not leave the watershed. It is noted on page 27 that sediment is retained in the stream system and noted on page 28 that sediment also settles onto the stream channel. If a significant portion of the 10,615 tons/yr of sediment from croplands is retained in the watershed, including the stream system, and this sediment results in negative impacts to beneficial uses, what are the specific flaws of the sediment budget analysis that do not provide an accurate link to the instream conditions?	provide a quantitative link to instream conditions; it does not establish a measurable relationship between watershed sediment erosion and loading to instream response. Therefore, it does not provide a way to use the watershed sediment erosion estimates and translate those into a resulting instream sediment concentration or conditions. Because the TMDL is ultimately assessed by instream conditions, the instream water quality monitoring data were used for the analysis to provide a direct link between the TMDL target (e.g., water column concentrations) and estimated instream sediment loading. As the incoming load is reduced, excess sediment, which has accumulated on the bed and banks of the stream will slowly be transported out of the system over time, resulting in a decrease in fine sediment levels. The rate of transport of accumulated sediment out of the system will depend on the incoming sediment load, and the annual flow regime, particularly peak flows.	
<u>Beneficial uses:</u>		
If there would continue to be more sediment introduced into the stream system each year than would be removed with the proposed TMDL, the final TMDL should include information that will demonstrate beneficial uses in Lake Creek will be improved.	After the TMDL is established, sediment will continue to enter the stream system, but at reduced rates. The TMDL establishes an ultimate loading goal or loading capacity that represents a level that will maintain designated uses. BMPs or other controls will be implemented that will reduce the amount of sediment entering the stream system. Eventually, the annual load entering the stream will meet the target goal. The load to be “removed” will not physically be removed from the system upon completion of the TMDL (e.g., through dredging or some other immediate action). But rather the load that enters the stream will systematically decrease because of the implementation of BMPs, until the load is at a level that supports uses.	

Responses to Comments
Commenter: David Karsann, Idaho Transportation Department, April 2, 2004

Comments	Response	Associated Change to Report
ITD requested a narrative approach for construction activities covered by its NPDES permit, and for the long-term operation of the highway. They requested a wasteload allocation.	The WLA must be numeric in TMDLs.	Please see section 2.3 TMDL endpoints for an explanation of the WLA. Management practices and monitoring recommendations are

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		also included in the TMDL.

References

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Appendix A: Summary of Idaho DEQ BURP Data for Lake Creek

Idaho DEQ uses BURP data to calculate stream habitat indices for evaluation of aquatic life use support (Grafe, 2002). A Stream Macroinvertebrate Index (SMI), Stream Fish Index (SFI), and Stream Habitat Index (SHI) are generated for each surveyed stream, where possible, and each index is rated based on different condition categories related to reference conditions (Table A-1 and Table A-2). The individual scores are then averaged into one condition rating that is used to determine use support. An average score of greater than or equal to 2 is considered fully supporting while an average score of less than 2 is considered not fully supporting. Table A-3 summarizes the available indices for Lake Creek, indicating that the creek does not fully support its aquatic life use.

Table A- 1. SMI Scoring Criteria for the Northern Mountains Region

Condition Category	SMI Scores	Condition Rating
Above the 25th percentile of reference condition	65–100	3
10th to 25th percentile of reference condition	57–64	2
Minimum to 10th percentile of reference condition	39–56	1
Below minimum of reference condition	<39	Minimum Threshold

Source: Grafe (2002).

Table A-2. SHI Scoring Criteria for the Northern Rockies Region

Condition Category	SHI Scores	Condition Rating
Above the 25th percentile of reference condition	66–100	3
10th to 25th percentile of reference condition	58–65	2
Below 10th percentile of reference condition	<58	1

Source: Grafe (2002).

Table A-3. Summary of Lake Creek Scores for Determination of Aquatic Life Use Support

Stream	Waterbody ID	BURP Site ID	SMI Score (0–100)	SMI Score (1–3)	SHI Score (0–100)	SHI Score (1–3)	Average Score	Support Status
Lake Creek (Lower)	17010303PN06	96NIRO0B18	42.05	1	50	1	1	Not fully supporting
Lake Creek (Upper)	17010303PN06	96NIRO0B19	39.4	1	50	1	1	Not fully supporting
Lake Creek (Upper)	17010303PN06	97NIRO0A01			54	1	1	Not fully supporting

Appendix B: Idaho Department of Transportation Wasteload Allocation Calculations

Sediment delivery to Lake Creek was estimated using a combination of the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) for a sequence of cases during construction of Highway 95. This summary includes a brief description of each construction scenario, estimates of delivery ratio to Lake Creek, and a summary of results.

- Case 1 (sediment yield associated with initial soil disturbance) is intended to represent the first scenario for sediment delivery to Lake Creek. This case has been revised to assume that best management practices (BMPs) have not been implemented during the 5-day duration. Therefore, there is no reduction in sediment yield.
- Case 2 (sediment yield associated with initial earth moving) has been added. This case assumes a 30-day period of time where bare soil is exposed but some BMPs are in place. The 30-day duration was not suggested by comments. Rather, it is an estimated period to represent the transition time period between initial disturbance and grading to final contours. The addition of Case 2 extends the estimated duration of the combined construction cases from 125 days in the previous analyses to 155 days in these analyses.
- The Rainfall Energy Factor (R) has been increased from 12 to 20. The soil loss equations are multiplicative relationships where the average soil loss per unit of area is directly proportional to R. Therefore, the revised results are (20/12) or 1.67 times greater than previous estimates.
- WEPP:Road was used to verify results of the soil loss equation analyses. WEPP:Road is an internet-based computer program from the U.S.D.A. Forest Service based on the Agricultural Research Service's Water Erosion Prediction Project (WEPP) model. To provide a side-by-side comparison for several individual pieces of the roadway prism, results of the USLE/RUSLE analysis were compared to results using WEPP:Road. The USLE/RUSLE results were generally higher than estimates from WEPP:Road but well within the estimation capability of these models in the absence of site-specific data. Some differences may be attributable to the R value estimates. The USLE/RUSLE results are based on using the R value of 20 while the WEPP:Road simulations were run based on a climate station in Moscow, ID.
- WEPP:Road was used to re-evaluate sediment delivery in close proximity to Lake Creek. The sediment delivery ratios immediately adjacent to Lake Creek (at the bridge construction site) were revised to reflect 100% delivery. Delivery ratios within 100 meters each side of Lake Creek were revised to 50%. WEPP:Road does not estimate sediment delivery beyond 300 meters of the stream. For most cases, WEPP:Road predicts zero delivery beyond 150 meters.

Following is a brief description of each of the construction cases. With the addition of another case, the cases have been re-numbered from the previous submittal. The long-term case associated with FHWA research has been deleted. It was previously included to compare the USLE/RUSLE results to the mean pollutant concentration in runoff from rural highways. Instead, cross checking results has been accomplished by comparison to WEPP:Road simulations.

CASE 1 – SEDIMENT YIELD ASSOCIATED WITH INITIAL SOIL DISTURBANCE

The USLE/RUSLE approach was used to estimate total soil yield for areas within the Lake Creek Watershed associated with U.S. 95, Setters to Bellgrove highway construction. Figure 1 illustrates the extent of the analysis area. Case 1 assumed original topography to characterize slopes and slope lengths. It was assumed that all areas were cleared and grubbed but that temporary or permanent erosion-control measures were not in place.

Based on a 5-day duration (assumed June 1 to June 5), in the absence of BMPs, the total erosion is estimated at 86.8 tons.

It should be noted that this represents the initial sediment yield for the total project area. The 5-day period is a one-time occurrence assigned to each area. The actual timing of these yields would be distributed over the entire duration of the construction project.

CASE 2 – SEDIMENT YIELD ASSOCIATED WITH INITIAL EARTH MOVING

The USLE/RUSLE approach was used for the same area as in Case 1. This case assumed original topography to characterize slopes and slope lengths. It was assumed that all areas were cleared and grubbed.

Based on a 30-day duration (assumed June 6 to July 5), in the absence of BMPs, the total erosion is estimated at 403.5 tons. In conjunction with clearing and grubbing, the contractor should construct all drainage- and sediment-control structures including earth dikes, rock-lined ditches, stone filter dams, and silt fence. These BMPs should reduce sediment yield by about 40%. The resultant estimated sediment yield would be approximately 242.1 tons.

It should be noted that this represents sediment yield for the total project area. The 30-day period is a one-time occurrence assigned to each area. The actual timing of these yields would be distributed over the entire duration of the construction project.

CASE 3 – SEDIMENT YIELD ASSOCIATED WITH CONSTRUCTION

The USLE/RUSLE approach was used for the same area as in Cases 1 and 2. This case assumed the post-construction topography to characterize slopes and slope lengths. Where the final plans indicate slope protection with rock armor, it was assumed that rock armor was in place. All other areas were assumed to be native material treated with mulch only (2 tons/acre).

Based on a 90-day duration (assumed July 6 to October 3), in the absence of BMPs, the total erosion is estimated at 69.7 tons. BMPs in place (earth dikes, rock-lined ditches, stone filter dams, and silt fence) should reduce sediment yield by about 50%. Percent reduction is higher for this case than Case 2 because drainage draw riprap and road-side ditches with stone-filter dams will be added with construction. Also, the control structures will be further stabilized with developing vegetation. The resultant estimated sediment yield would be approximately 34.9 tons.

It should be noted that this represents sediment yield for the total project area. The 90-day period is a one-time occurrence assigned to each area. The actual timing of these yields would be distributed over the entire duration of the construction project.

CASE 4 – SEDIMENT YIELD ASSOCIATED WITH CONSTRUCTION

The USLE/RUSLE approach was used for the same area as in Cases 1 through 3. This case assumed the post-construction topography to characterize slopes and slope lengths. Where the final plans indicate slope protection with rock armor, it was assumed that rock armor was in place. It is assumed that all roadway areas are covered with rock cap. Areas treated with mulch (2 tons/acre) include the median and slopes not protected with rock armor.

Based on a 30-day duration (assumed October 4 – November 2), in the absence of BMPs, the total erosion is estimated at 19.3 tons. BMPs in place (earth dikes, rock-lined ditches, stone filter dams, and silt fence) should reduce sediment yield by about 60%. Percent reduction is higher for this case than Case 3 because the control structures will be further stabilized with developing vegetation and fines in rock-lined ditches should be washed away. The resultant estimated sediment yield would be approximately 7.7 tons.

It should be noted that this represents sediment yield for the total project area. The 30-day period is a one-time occurrence assigned to each area. The actual timing of these yields would be distributed over the entire duration of the construction project.

CASE 5 – SEDIMENT YIELD ASSOCIATED WITH CONSTRUCTION AREAS FOLLOWING COMPLETION OF CONSTRUCTION ACTIVITIES

The USLE/RUSLE approach was used for the same area as in Cases 1 through 4. This case assumed the post-construction topography to characterize slopes and slope lengths. Where the final plans for Setters to Bellgrove indicate slope protection with rock armor, it was assumed that rock armor was in place. It is assumed that all roadway areas were paved and that all areas have been revegetated.

The construction cases (Cases 1 through 4) are assumed to occur over a span of 155 days from June 1 to November 2. To estimate the total erosion that may occur during a full construction year, Case 5 was developed to predict sediment yield during the remainder of the year.

Based on a 210-day duration (assumed November 3 to May 31), in the absence of BMPs, the total erosion is estimated at 49.1 tons. BMPs in place (earth dikes, rock-lined ditches, stone filter dams, and silt fence) should reduce sediment yield by about 60%. Like Case 4, percent reduction is higher for this case than Case 3 because the control structures will be further stabilized with developing vegetation and fines in rock-lined ditches should be washed away. The resultant estimated sediment yield would be approximately 19.6 tons.

CASE 6 – SEDIMENT YIELD ASSOCIATED WITH POST CONSTRUCTION PROJECT

This case is similar to Case 5 but predicts sediment yield for a full calendar year following the completion of all construction. This case assumed the post-construction topography to characterize slopes and slope lengths. Where the final plans for Setters to Bellgrove indicate slope protection with rock armor, it was assumed that rock armor was in place. It is assumed that all roadway areas were paved and that all areas have been revegetated.

Based on a 365-day duration, in the absence of BMPs, the total erosion is estimated at 135.6 tons per year. BMPs in place (earth dikes, rock-lined ditches, stone filter dams, and silt fence) should reduce sediment yield by about 60%. Like Case 4, percent reduction is higher for this case than Case 3 because the control structures will be further stabilized with developing vegetation and fines in rock-lined ditches should be washed away. The resultant estimated sediment yield would be approximately 54.2 tons per year.

SEDIMENT DELIVERY TO LAKE CREEK

The soil loss equations are useful for predicting the amount of soil loss from the construction site, referred to as gross erosion. Between the construction sites and Lake Creek, sediment will normally have numerous opportunities to be deposited, reducing the sediment yield accordingly. The sediment delivery estimates consider the flow paths from the edge of the highway right-of-way to the main stem of Lake Creek.

The degree of channelization affects how efficiently eroded sediment can be transported through a watershed channel system. A well-channelized watershed will transport most eroded material out of the watershed, whereas a poorly channelized watershed will transport the sediment slowly, leaving many opportunities for depositions.

As discussed in the introduction, WEPP:Road was used to evaluate sediment delivery in close proximity to Lake Creek. The sediment delivery ratios immediately adjacent to Lake Creek (at the bridge construction site) were revised to reflect 100% delivery. Delivery ratios within 100 meters each side of Lake Creek were revised to 50%.

WEPP:Road does not estimate sediment delivery from areas beyond 300 meters of the stream and in most cases, WEPP:Road predicts zero delivery beyond 150 meters. A method developed by the Forest Service was used to estimate sediment delivery ratios for areas further than 300 meters from Lake Creek. The Forest Service (1980) methodology for predicting sediment delivery ratio is a function of:

- delivery distance from slope to stream

- slope shape
- percentage of ground cover
- texture of eroded material
- surface runoff
- slope gradient
- surface roughness

Where the analysis area is 300 meters or further from the stream, this methodology was used to estimate sediment delivery to Lake Creek from U.S. 95. Delivery ratios range from 5% at the extremes of the subwatersheds to 100% at the bridge construction site. Figure 1 illustrates the variation in the sediment delivery ratios.

SUMMARY

Table 1 summarizes the estimates of annual sediment delivery to Lake Creek during a typical construction year of the Setters to Bellgrove project. Based on an assumed 3-year construction project, total erosion estimates (predicted by the USLE/RUSLE computations for Cases 1 through 5) have been divided by 3 to represent one-third of the area disturbed during a typical construction year. Post-construction Case 6 estimates erosion from the remaining two-thirds of the total area.

Table B-1: Sediment Delivery Predicted for a Typical Construction Year

	Duration (days)	Total Project Erosion (tons)	Annual Erosion (tons/year)	Sediment Yield with BMPs (tons/year)	Delivery Ratio	Delivery to Lake Creek (tons/year)
Case 1	5	86.8	28.9[1]	28.9	5 to 100%	2.8
Case 2	30	403.5	134.5[1]	80.7		7.7
Case 3	90	69.7	23.2[1]	11.6		1.1
Case 4	30	19.3	6.4[1]	2.6		0.3
Case 5	210	49.1	16.4[2]	6.5		0.6
Case 6	365	135.6	90.4[3]	36.2		3.5
***TOTAL*:**	**365 days**		**299.8**	**166.5**	**5 to 100%**	**16.1**

[1] Based on 3 years of construction – total erosion for each construction case is multiplied by 1/3 to account for 1/3 of the total area under construction in a typical construction year.
[2] Based on 3 years of construction – total erosion from post construction Case 5 is multiplied by 1/3 to account for the remainder of the year (210 days) for 1/3 of the total area under construction in a typical construction year.
[3] Based on 3 years of construction – total annual erosion from post construction Case 6 is multiplied by 2/3 to account for 2/3 of the total area that is not under construction in a typical construction year.

Estimated sediment delivery to Lake Creek during construction is 16.1 tons per year. This estimate assumes 3 years of construction. Because of uncertainties associated with funding the project, the actual duration of construction may be longer than 3 years. If construction continues for more than 3 years, the timing of construction-related sediment delivery will also be prolonged and annual delivery rates would be lower than predicted for 3 years. However, the total amount of sediment delivered to Lake Creek from construction would remain the same. Table 2 presents estimates based on various construction schedules.

Table B-2: Variation in Annual Sediment Delivery as a Function of Construction Schedule

Duration of Construction:		3 years	4 years	5 years	6 years
Case1	5 days	2.8	2.1	1.7	1.4
Case 2	30 days	7.7	5.8	4.6	3.9
Case 3	90 days	1.1	0.9	0.7	0.6
Case 4	30 days	0.3	0.2	0.2	0.1
Case 5	210 days	0.6	0.5	0.4	0.3
Case 6	365 days	3.5	4.0	4.2	4.4
TOTAL DELIVERY (tons/year)		***16.1***	***13.4***	***11.8***	***10.7***

LONG TERM SEDIMENT DELIVERY

The long-term condition (following cessation of construction activities) is represented by Case 6. Annual long-term delivery to Lake Creek is estimated at 5.3 tons per year.

Table B-3: Sediment Delivery Predicted Following Construction

	Duration (days)	Erosion (tons/year)	Sediment Yield with BMPs (tons/year)	Delivery Ratio	Delivery to Lake Creek (tons/year)
Case 6	365	135.6	54.2	5 to 100%	5.3

Appendix C: Proposed Monitoring Plan, Idaho Transportation Department

The TMDL will specify that the SWPP for the construction general permit must incorporate TMDL provisions including a monitoring plan, which has been agreed upon by ITD and the Tribe for implementing the wasteload allocation discussed above. It is expected that this monitoring plan will be finalized during the Implementation phase of the TMDL. However, the key elements of the monitoring plan, as agreed to by ITD and the Tribe at this time, are shown below (note that the elements below are in addition to those specified the Quality Assurance Turbidity Sampling Plan [QATSP] attached to the 401 Water Quality Certification for the U.S. 95 project issued by EPA on March 12, 2004):

- ITD will install and maintain 3 sensors that continuously measure turbidity and water level; the locations of these sensors will be upstream of the U.S. 95 project (site L-1 in the QATSP), downstream of the U.S. 95 project (site L-2 in the QATSP), and at the site further downstream referred to as the Godde site in the TMDL report. These sensors will be maintained at these locations for the duration of the ITD construction activities in the Lake Creek watershed, contingent upon property access permission from the private property owner for the Godde location and permission from the Kootenai/Shoshone Soil Conservation District to use the bridge at the location.

- ITD will collect data for developing a correlation relationship between turbidity and TSS in the vicinity of the U.S. 95 project. The goal will be to collect 10 samples reflective of a range of flow and TSS/turbidity conditions. Spring and early summer 2005 will be the targeted period for this data collection, assuming appropriate hydrologic conditions occur.

- ITD will also develop stage-discharge relationships for the 3 mainstem sites. These will be developed initially concurrent with the development of the TSS/turbidity relationship, and supplemented and checked periodically over the duration of monitoring. The stage-discharge relationships will be used to estimate flows and define which of the TSS targets are applicable to which time periods.

- ITD will conduct manual sampling events on at least a weekly basis and in conjunction with substantive storm events (consistent with the QATSP). These events will consist of turbidity and staff gage readings at the 3 mainstem sites, and TSS sampling for the first 10 weeks. Thereafter TSS samples will be analyzed periodically to continue to build the TSS/turbidity relationship under varying flow conditions (these will be quarterly, at the minimum).

- Depth-integrated, equal width increment sampling will be conducted at the 3 mainstem sites during TSS sampling events to the extent that safe access to the stream is available during any given event at each of the sites. The TSS analysis method will be EPA method #160.2 (Standard Methods #2540 D). Continuous and manual turbidity analyses will be consistent with the QATSP (one difference is that YSI Model 6920 sensors are now being used in place of the In-situ sensors identified in the QATSP; these YSI units have proven to be more reliable).

- ITD will also monitor and document turbidity at various locations in the tributary stream that enters the mainstem from the east between the L-2 and Godde sites. The purpose of this monitoring will be to document the sources of sediment in this tributary in the event that the TSS targets in the mainstem are exceeded at the Godde site. It is understood that an exceedance of a TSS target at the Godde site does not necessarily represent non-compliance by ITD because there are other sediment sources to this tributary, as documented in the TMDL report. Flow in this tributary may be estimated based on the depth of water in the culvert and standard rating curves for culverts for a given slope. These estimates may be used to back-calculate mainstem flows as described above (e.g., flow at L-1 and L-2 can be based on flow at the Godde site minus the tributary flow).

- The lateral placement of the turbidity sensor in the Godde site transect will be such that data recorded will be as representative as reasonably possible of the average value across the transect (the TMDL report documents that the tributary from the east immediately upstream of the Godde site does not always completely mix with the mainstem at this site).

- Manual turbidity data will continue to be reported to the Tribe and EPA as specified in the QATSP. Continuous sensor data will be reported periodically following QC review (at least quarterly). All raw sensor data will be retained and provided on request along with reasons that any raw data were censored or qualified. The results of the intensive TSS, turbidity and flow data collection in early 2005 will be provided as a separate technical memorandum. Additional TSS and flow measurements taken over time will be provided in the regular QATSP report covering the time period in which the data were obtained.

- ITD will consult with the Tribe in the event that any of the above elements need to be modified due unanticipated access constraints, hydrologic conditions, construction activities, or other factors.

Appendix D: Excerpts on TMDLs from the NPDES General Permit for Storm Water Discharges from Construction Activities, No. IDR10-0000 and associated Fact Sheet

(Note: This permit uses the term "you" and "your" to identify the operator of the construction project subject to the terms of the permit. The full text of this permit, and other relevant documents, can be found on-line at **http://www.epa.gov/npdes/stormwater/cgp**)

Part 1.C.5.
Discharging into Receiving Waters With an Approved Total Maximum Daily Load Analysis

a. You are not eligible for coverage under this permit for discharges of pollutants of concern to waters for which there is a total maximum daily load (TMDL) established or approved by EPA unless you incorporate into your SWPPP measures or controls that are consistent with the assumptions and requirements of such TMDL. To be eligible for coverage under this general permit, you must incorporate into your SWPPP any conditions applicable to your discharges necessary for consistency with the assumptions and requirements of such TMDL. If a specific wasteload allocation has been established that would apply to your discharge, you must incorporate that allocation into your SWPPP and implement necessary steps to meet that allocation.

b. In a situation where an EPA-approved or established TMDL has specified a general wasteload allocation applicable to construction storm water discharges, but no specific requirements for construction sites have been identified in the TMDL, you should consult with the State or Federal TMDL authority to confirm that adherence to a SWPPP that meets the requirements of the CGP will be consistent with the approved TMDL. Where an EPA-approved or established TMDL has not specified a wasteload allocation applicable to construction storm water discharges, but has not specifically excluded these discharges, adherence to a SWPPP that meets the requirements of the CGP will generally be assumed to be consistent with the approved TMDL. If the EPA-approved or established TMDL specifically precludes such discharges, the operator is not eligible for coverage under the CGP.

CGP, Part 3.14 :
Documentation of Permit Eligibility Related to Total Maximum Daily Loads

The SWPPP must include documentation supporting a determination of permit eligibility with regard to waters that have an EPA-established or approved TMDL, including:

A. Identification of whether your discharge is identified, either specifically or generally, in an EPA-established or approved TMDL and any associated allocations, requirements, and assumptions identified for your discharge;

B. Summaries of consultation with State or Federal TMDL authorities on consistency of SWPPP conditions with the approved TMDL, and

C. Measures taken by you to ensure that your discharge of pollutants from the site is consistent with the assumptions and requirements of the EPA-established or approved TMDL, including any specific wasteload allocation that has been established that would apply to your discharge. See section 1.3.C.5 for further information on determining permit eligibility related to TMDLs.

CGP Fact Sheet Discussion, pages 17-18
Discharging into Receiving Waters With an EPA Approved or Established Total Maximum Daily Load (TMDL) Analysis

A Total Maximum Daily Load (TMDL) is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. Under current regulations and EPA program guidance (40 CFR §130.2 and §130.7), states establish TMDLs that include wasteload allocations from point sources, and load allocations from non-point sources and natural background conditions. Wasteload allocations are defined as the portion of a receiving water's loading capacity that is allocated to point sources dischargers. TMDLs are established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards with seasonal variations and a margin of safety that take into account any lack of knowledge concerning the relationship between effluent limitations and water quality. TMDLs are developed on a pollutant- and waterbody-specific basis. In some instances, TMDLs may combine multiple pollutants into one set of TMDL documents; however, the specific TMDL wasteload and load allocations are to be pollutant-specific. States are responsible for establishing TMDLs, which EPA approves. In some instances, EPA establishes the TMDLs. Once established or approved by EPA, TMDLs are implemented through water quality management plans and through NDPES permits. NPDES regulations, at 40 CFR §122.44(d)(1)(vii)(B), require that EPA ensure that NPDES permit limits are consistent with the assumptions and requirements of any available wasteload allocation pursuant to 40 CFR §130.7. Generally, this requires EPA to ensure that NPDES permits incorporate applicable assumptions and requirements detailed in TMDLs approved or established by EPA.

Those seeking coverage under the CGP are responsible for determining whether specific conditions, over and above other requirements of the CGP, have been identified by the TMDL authority as necessary to ensure consistency with the assumptions and requirements of TMDLs approved or established by EPA. There may be documents accompanying the TMDL (e.g., an implementation plan) or other documents that indicate the TMDL writer's intent to allocate a load for an individual discharger or for a class of dischargers. To the extent such documents are available, the operator should consider these materials when determining whether your discharge will be consistent with the TMDL. EPA encourages the operator to contact the authority that established the TMDL -- in most cases, the states -- to seek clarification if significant concerns exists over whether its activity will be consistent with a TMDL.

Consistent with EPA regulations and guidance, the CGP requires that the operator determine whether an EPA approved or established TMDL exists that specifically addresses its discharge and if so, take necessary actions to be consistent with the assumptions and requirements of that approved TMDL. To make this determination, the operator will need to (1) determine the waterbody into which it discharges, (2) identify if there is an approved TMDL for that waterbody, (3) determine if that TMDL includes specific requirements (e.g., wasteload allocation or load allocation) applicable to its construction site, and (4) if so incorporate those requirements into the SWPPP and implement necessary steps to comply with them. EPA generally agrees that construction activities should not be delayed because the TMDL authority failed to specify all sources of loading in the TMDL. EPA is not requiring that construction activities be delayed until such time as a TMDL can be revised. EPA has utilized a framework that allows the construction site operator to obtain clarification from the TMDL authority on discharge provisions that would allow authorization under the CGP. EPA established a website at www.epa.gov/npdes/stormwater/cgp that includes links to state TMDL information and contacts. EPA expects that permittees can access that website and identify either (1) the steps needed to be consistent with the assumptions and requirements of the TMDL or (2) a state or regional contact for making this determination. The operator may access that site or contact their state environmental agency or EPA region directly to make this determination. For construction activity authorized by EPA Region 8, TMDL information and contacts are available at: www.epa.gov/region08/water/stormwater/index.html. For more information on EPA's National TMDL program, including state and regional contacts, state maps showing impaired waterbodies, and example TMDLs, visit: www.epa.gov/owow/tmdl.

EPA recognizes that TMDLs vary in the complexity of their assumptions and quantification. In the process of determining whether or not an operator is consistent with the TMDL, the state or regional

TMDL contact may request additional information. The TMDL may include details regarding recommended implementation activities that include certain narrative provisions such as implementation of specific BMPs; specified inspection, discharge monitoring or characterization, education, tracking or reporting requirements; or some combination of these or other conditions. In addition, some States may include implementation provisions in their TMDLs, although EPA regulations do not require this, and EPA does not approve or disapprove TMDLs based on these implementation provisions. However, any implementation language included in the TMDL that applies to construction general permit discharges should be considered part of the TMDL for the purposes of determining consistency of the SWPPP with the TMDL. Further, EPA is clarifying that if the TMDL includes load allocations that the permitting jurisdiction later determines is for a discharge subject to this permit, then the load allocation is considered to be a wasteload allocation, and the SWPPP needs to demonstrate consistency with any specific requirements implementing this load allocation.

As described in the permit, EPA will begin with the general assumption that where EPA has approved a TMDL that does not include a specific allocation for storm water discharges, or where the TMDL authority clarifies that it did not include a specific allocation for storm water or for construction activities, adherence to a SWPPP that meets the requirements of the CGP will be consistent with the assumptions and requirements of such TMDLs. Inferring that the TMDL authority did not intend to make it impossible to permit storm water discharges in the absence of any discussion on this topic in the TMDL is reasonable because both construction activity and rainfall are so ubiquitous that it is unlikely that a policymaker would make such a significant decision consciously through silence. EPA will generally assume that such discharges were accounted for by the author of the TMDL, even if such discharges are not addressed specifically. Therefore, in the situation where an EPA approved or established TMDL has not specified a wasteload allocation for construction storm water discharges, but has not specifically excluded these discharges, compliance with a SWPPP that meets the requirements of the CGP will generally be assumed to be consistent with the approved TMDL. Similarly, where an EPA approved or established TMDL has specified a general wasteload allocation for construction storm water discharges, but no specific requirements for individual construction sites have been identified, either in the TMDL, a watershed plan, or other similar document, then compliance with a SWPPP that meets the requirements of the CGP will generally be assumed to be consistent with the approved TMDL. If the EPA approved or established TMDL specifically precludes such discharges, the operator is not eligible for coverage under the CGP. In selecting this approach, EPA is trying to balance the need to include permit conditions consistent with TMDLs with the need to clearly define permittee responsibilities.